

Linzer biol. Beitr.	28/2	999-1052	31.12.1996
---------------------	------	----------	------------

The identity of *Pinus ponderosa* DOUGLAS ex C. LAWSON (*Pinaceae*)

F. LAURIA

Abstract: *Pinus ponderosa* s.l. is a commercially important and polymorphic conifer. Its taxonomy (and that of its entire group, the 'ponderosa complex') is far from being settled (KRAL 1993). This unsettled status is largely due to absence of a type, a circumstance which also accounts for the fact that even the very identity of *Pinus ponderosa* s.str. itself is notoriously confused. The earliest sources documenting the intricacies of the discovery and late publication of ponderosa pine as a new species in 1836 are reviewed. Detailed study of its earliest botanical history is demonstrated to be essential to finally establish its original identity, as meant by David Douglas and described by Charles Lawson. *Pinus ponderosa* DOUGLAS ex C. LAWSON is then neotypified with authentic material (an ovuliferous cone) discovered in a historical collection of conifer cones surviving at the Natural History Museum in Vienna, Austria [W]. The extensive synonymy pertaining to the 'ponderosa complex' is reviewed (including typification of several of these synonyms) and some new facets of the life and achievements of David Douglas, who is commonly credited with the discovery of *Pinus ponderosa*, are also reported here for the first time.

Key words: David Douglas, biography, *Pinaceae*, *Pinus*, *Ponderosae*, ponderosa complex, *Pinus ponderosa*, *Pinus washoensis*, taxonomy, typification, synonymy, botanical history.

Introduction

Pinus ponderosa DOUGLAS ex C. LAWSON (1836) sensu lato (as meant by SHAW 1914; see recent review in CONKLE & CRITCHFIELD 1988) is a polymorphic pine native to almost all western states of the United States of America, and adjacent southwestern Canada and northern Mexico. Its taxonomy (and consequently that of all related taxa composing its 'complex') is far from being convincingly settled (e.g. KRAL 1993, p. 391) and has never been comprehensively revised (but note: CALLAHAM, in prep., personal communication 1995). Moreover, the species even proves never to have been typified (FARJON 1991, 1993). With it not being typified, it is not surprising that the taxonomic, ecological, genetic and forestry literature shows that workers in different parts of the species' range have quite different notions of some of the basic characteristics of *Pinus ponderosa* s.str. A prudent procedural approach is clearly required to establish its correct identity, before an accurate

determination of the true type on which the name is based can be made. In order not to prejudge a taxonomic revision of the complex, this determination should be independent of any potentially biased preconceptions concerning the past, present, or possible future status of taxa, but based solely on the earliest sources of information concerning the species' original collection and description. The data documenting these details and the peculiarities of the discovery and subsequent history of *Pinus ponderosa* are scattered in a multitude of early, mainly British publications, many of which are still standard references on the botanical exploration of North America. Before demonstrating the impact the many interesting historical details of the discovery of *Pinus ponderosa* exert on taxonomic research, introductions to the intricacies associated with current ponderosa pine taxonomy, and with the explorer David Douglas and his time are presented.

Current status of *Pinus ponderosa* taxonomy

Two varieties, the type, var. *ponderosa*, and var. *scopulorum* ENGELMANN (1879b) have long been recognized in *Pinus ponderosa* s.l., though not always with great conviction; opinions ranged at various times from accepting Engelmann's varieties, to specific status for *Pinus scopulorum* (LEMMON 1897), to complete lumping of all varieties (in fact virtually all near relatives of ponderosa pine) into only one polymorphic entity (SHAW 1914, SUDWORTH 1917), to subspecific rank for the taxon '*scopulorum*' (MURRAY E. 1982, WEBER 1982), and vice versa. The aforementioned infraspecific taxa have in turn been split into a number of 'races' (WEIDMAN 1939) or 'ecotypes' (WELLS 1964) of ambiguous taxonomic status, differing in their growth, morphology, chemistry and ability to intercross (reviewed in CONKLE & CRITCHFIELD 1988). This situation appears chaotic and is in need of revision. One of the distinct races, that of the North Plateau, encompasses populations of the Columbia River region which David Douglas explored and from where his collections of *Pinus ponderosa* s.str. uncontestably came.

However, it is another of the races experimentally shown in the more recent past, to be (probably even taxonomically) distinct in several respects, the Pacific race of central California, which is since long erroneously but persistently considered to be the very 'archetype' of *Pinus ponderosa* s.l. Virtually all investigations potentially relevant to the taxonomy and systematics of ponderosa pine as a whole have all, since long, exclusively been carried out with the Pacific race of California, and not with *Pinus ponderosa* s.str. from the North Plateau. The historical reasons for this confusion have already been detailed elsewhere (LAURIA 1996).

The significance for ponderosa pine taxonomy, of the various racial differences detected during some 80 years of testing (provenance trials, artificial infraspecific hybridization experiments, etc...), seems to be considerable (CALLAHAM, in prep., per-

sonal communication 1995). The results of historic interspecific hybridization experiments carried out with only one (and moreover false 'archetype-') race of *Pinus ponderosa* s.l. (and e.g. several Southern pines of subs. *Australes*) are thus likely to have deluded former investigators into wrong conclusions (i.e. the separation of subs. *Australes* from the *Ponderosae*, DUFFIELD 1952, CRITCHFIELD 1963), and the current systematic position of *Pinus ponderosa* in general and that of other congeneric taxa may be quite misleading.

Contrary to the Pacific race, the North Plateau race of Douglas' general type area appears to be the one race least studied from the botanical point of view; apart from short accounts in local floras and in scattered 19th century exploration reports of the region, no full botanical study exists. Pines often exhibit considerable phenotypic plasticity, and in this *Pinus ponderosa* s.str. is certainly no exception. All considered it remains unclear, however, whether this broad plasticity in the type variety generally, and in the North Plateau race in particular, may not be simply an artefact resulting from inadequate botanical exploration in at least this part of the species' range.

It must be remembered that several additional taxa have been named or split off from ponderosa pine as separate species; most of them are listed in SHAW (1914). Those significant in this context from the general area of the type variety are *Pinus benthamiana* HARTWEG (1847), *P. jeffreyi* BALFOUR ex A. MURRAY (1853), *P. beardsleyi* A. MURRAY and *P. craigana* A. MURRAY (1855). Of all these taxa, *Pinus jeffreyi* is now universally accepted as a distinct species, often primarily (and sometimes only) because of its very different biochemistry. The need for a re-evaluation of *Pinus benthamiana* has been suggested recently (LAURIA 1996), but the other taxa have also, like Bentham's pine, never been thoroughly studied in situ. Since *Pinus ponderosa* itself is not yet typified, the status of these largely still unexamined taxa must also remain open.

Another closely related taxon split off from ponderosa pine in the more recent past is *Pinus washoensis* (MASON & STOCKWELL 1945), which continues to be a matter for debate and confusion (see references in LAURIA 1991). There are repeated, but perseveringly disregarded and, therefore, still unverified, reports (detailed in NIEBLING & CONKLE 1990, p. 307) that this purported narrow endemic of extreme north-western California and adjacent areas may also be widespread among populations of North Plateau ponderosa pine, i.e. within the very area of *Pinus ponderosa* s.str. Therefore, apart from the notoriously ambiguous and vague taxonomic status of infraspecific, ecotypic and racial units in *Pinus ponderosa* s.l. (including that of its synonyms), this situation again confirms the need for a renewed botanical exploration of *Pinus ponderosa* of at least the North Plateau region and underlines the paramount importance of correctly determining the true identity of *Pinus ponderosa* s.str.

David Douglas

David Douglas was one of the most successful early 19th century natural history travellers of western North America, where he mainly explored the Columbia River region and California. Several biographies of his life and achievements exist (e.g. HARVEY 1947). However, several details following from his achievements, despite their great historical importance, remain unresolved to this day.

Douglas was sent out on his missions by the Horticultural Society of London at the suggestion of the eminent botanist Sir W.J. Hooker, with instructions to collect - among other items of natural history - herbarium specimens and seeds of all plants he considered new or otherwise of interest. Hooker, with several other British botanists connected with the Society (notably John Lindley and George Bentham), and David Don, who worked in A.B. Lambert's important library and herbarium, were the first to receive Douglas' collections for study; they were also the first to publish many of his discoveries. There was a nearly constant flow of new plants being named, described and published by one or another of these botanists, in the many articles and books today documenting Douglas' many discoveries, from the time his first specimens and seeds arrived to several years after his untimely death. The majority of these appeared in the 'Transactions of the Horticultural Society', in 'Edwards' Botanical Register', in the 'Botanical Magazine', in HOOKER's 'Flora Boreali-Americana' and in later editions of LAMBERT's 'A Description of the Genus *Pinus*'.

However, there have been some significant exceptions to this well-established procedure of early publication for most of Douglas' discoveries, particularly among some of the conifers he saw and collected on his first mission to the Columbia River region in 1825-1827. He misidentified many of these in the field, confusing them with other species already well-known from eastern North America or elsewhere, as noted by BALFOUR (1942, 1945). Douglas' diaries (DOUGLAS 1914) refer to e.g. *Pinus banksiana* (for *Pinus contorta*), and *Thuja occidentalis* (for *Thuja plicata*). This failure by early 19th century explorers and botanists to recognize new taxa as distinct, with the resulting misapplication of names, was frequent; a casual inspection of 'Index Kewensis' (JACKSON 1893 ff.) extensively testifies to this.

While misidentification of objects of natural history seen in the field does not need to be explained, at least some of these objects (plants) noted on these various expeditions were visibly different from any known taxa and must have been so also to any layman. Some of this misnaming appears, therefore, to have been deliberate. This peculiar phenomenon was researched by CRISWELL (1940) in respect of its occurrence in the diaries of Meriwether Lewis and William Clark, commanders of the great American transcontinental expedition of 1804 to 1806. CRISWELL explained this phenomenon as follows:

'..., one of the hardest problems facing Lewis and Clark was that of naming their discoveries, especially those in the animal and plant worlds [p. CXIX]. The first aim, then, of the explorers was to make their discoveries understandable to the people at home ... [p. CXX]. Now, those who would set about the business of giving new names to new objects can take as point of departure only what they already know [p. CXIX]. The most prolific of all methods of naming was the adaptation to new things of terms already in use, that is, the extension of the meaning of a term to cover a new thing. This was probably the easiest method to use, and it had the added advantage that such names would have meaning for the people at home [p. CXXVIII]'.

This provides a convincing interpretation of Lewis' and Clark's intentions, and it is presumed here that David Douglas may very well have been directed by similar lines of thought when he too misapplied names.

Surprisingly, however, several misidentified and misnamed novelties among the conifer specimens in Douglas' collections were also completely overlooked by all contemporary professional botanists at home for some ten years or more before finally being made known to the botanical world by horticulturists, in publications which were considered ephemeral and of only little scientific value by these botanists. Reasons for this development are varied and deeply hidden in the early botanical history of these taxa. *Pinus ponderosa* and *Pinus contorta* (Douglas' '*Pinus banksiana*') have both experienced a very similar early botanical history in this respect.

The discovery of *Pinus ponderosa*

The earliest published account of Douglas' explorations which documents the date and place of the asserted discovery of ponderosa pine was made by W.J. HOOKER as late as 1836, two years after Douglas' death, and ten years after the purported discovery of the pine and collection of a specimen of it. HOOKER (1836) reports that Douglas 'saw a new *Pinus* (*P. ponderosa*)' in May 1826 when he travelled a region near the present city of Spokane, Washington.

Hooker's reference to the species is however not a valid publication of the name, but a nomen nudum without a description; the locality named is therefore irrelevant. In even earlier sources (as to the date of their origin), in Douglas' own field notes (journals) not published until 80 years after his death (DOUGLAS 1914), there is no mention of a *Pinus ponderosa* at all. Unlike *Pinus lambertiana*, which Douglas instantly recognized as both a new species and a horticulturally important discovery, he always mentions *P. resinosa* every time he saw the pine now known to be *P. ponderosa*, a misidentification that was to confuse several contemporary botanists and fellow botanical explorers of the Pacific Northwest alike.

So when and where was this pine first concluded to be new?. For most of the ten years before Hooker's citation, young plants of *Pinus ponderosa* were already available under that name to the public in Britain; the name appeared in horticultural literature on several occasions, though only as an 'informal name', without description. It had clearly already become a widely accepted name among the conifer connoisseurs of the time, yet no description to safeguard or characterize the name was published. This was despite the fact that contemporary botanists were keen to publish most of Douglas' other discoveries. The explanation of this omission and discrepancy is again found in Douglas' journals: What he actually collected near present-day Spokane was not *Pinus ponderosa*, nor *P. resinosa*, but a specimen of the parasitic mistletoe *Arceuthobium* (*A. campylopodum* ENGELM.) on what he thought was *P. resinosa*.

How can this be reconciled with the differing text in the account published by HOOKER in 1836?: Douglas was given the right (not a matter of course at that time) to draw financial profit from the publication of an account of his travels, which he was expected to compile from his journals. Two short versions of the journals exist (HARVEY 1947). Both were written in 1829 (see below), before Douglas left England on his ill-fated third trip to North America. One of these extracts is the account edited and published by HOOKER in the 'Companion to the Botanical Magazine' in 1836, the other is printed in DOUGLAS (1914, p. 51-76). In HOOKER's version, the discovery and collection of an *Arceuthobium* on *Pinus resinosa* was converted into the notification of a new pine, *P. ponderosa*, and the collection of a specimen of *Arceuthobium* on this new pine. Two important conclusions must be deduced from this: First, that unlike several other conifers, Douglas did not realize the pine was a new species when he saw it, and second, as a result, that no specimen of the pine in itself was collected at the time.

One month after his return from the first expedition to the Columbia River in October 1827, Douglas' paper on the discovery of *Pinus lambertiana* was read to the Linnean Society (DOUGLAS 1827). In it he reported that *Pinus resinosa* occurs among *P. lambertiana*; this clearly refers to the misidentified *P. ponderosa*, a common associate of *P. lambertiana*. Therefore ponderosa pine cannot have been recognized as a new species until after this paper was published.

Conifers enjoyed very high popularity at this time, and many English gardens were striving to maintain comprehensive collections of exotic trees (LOUDON 1836a;c;d); some published lists of species both in possession and still in need of acquisition. Dropmore (Buckinghamshire, England) published one such list in the 'Gardener's Magazine' (BAILLIE & LOUDON [January] 1828). In it, *Pinus lambertiana*, introduced by Douglas as seed only three months before, is included among the desiderata; *Pinus ponderosa* is not mentioned at all. It is also not mentioned in LOUDON (1829, published in June or early July, the preface is dated May 1829).

After his return from America in October 1827, Douglas remained in the service of the Horticultural Society, but was not happy in London, not fitting well in the social set-up there (HARVEY 1947). As a result, his herbarium work on his specimens was neglected. This was noted by Lindley, assistant secretary to the Society; in April 1829 he summoned Douglas to his office for a reprimand. Hooker also attended this conversation. A detailed memo of it still exists today among the 'Douglas Manuscripts' preserved at the Royal Horticultural Society. Following this Douglas now diligently arranged his herbarium and notes.

On 22 June 1829 Douglas wrote to Joseph Sabine: 'Sir, I beg to know in what shape you wish the abstract of my journey as a preface to the account of the American Pines to appear. Whether as a memorandum to you or whether in my name and in my words, which should be forthwith done as you desire. ...' (letter among the 'Douglas Manuscripts' kept at the Royal Horticultural Society's Lindley Library).

By July 1829, the Horticultural Society had made up its mind to send Douglas out on another mission to North America (HARVEY 1947). Extensive preparations for this voyage began immediately, and Douglas had no further time for herbarium work or to continue writing accounts. He departed in October 1829.

Therefore, it will have been in this period between April and July 1829 that Douglas concluded (or was pointed to the fact that) he had a new pine among his specimens. It must have been at this stage that he converted his annotation *Pinus resinosa* to *Pinus ponderosa* on his herbarium-sheet of *Arceuthobium*. This was also the time when he finally completed the two abstracts of his adventures (compiled from his journals) mentioned before. And Douglas at this stage wrote the manuscript 'Some American Pines' (kept at the Society Library, but not published until 1914: DOUGLAS 1914, p. 338-348). In this descriptive enumeration Douglas fully refers to *Pinus ponderosa* with no mention of *P. resinosa*. He states however that *P. ponderosa* is 'only of the interior', citing places now in northeastern Oregon, eastern Washington, Idaho, and southeastern British Columbia. Unlike these interior ponderosa pines, Douglas here refers the *Pinus ponderosa* trees in southwestern Oregon, those found with *Pinus lambertiana*, to *Pinus rigida* (DOUGLAS 1914, p. 346, 347) despite calling them *P. resinosa* in 1827. It is interesting to note that Douglas with hindsight regarded these coastal trees (the 'Pacific race' ponderosa pine of modern papers) as a different species.

A further detail of note is that in the account published by HOOKER in 1836, the name *Pinus ponderosa* is used for that one entry for May 1826 only, but *P. resinosa* is maintained on every other occasion in that work. This is very odd, as by the time this account was written in 1829, Douglas had clearly distinguished ponderosa pine.

There appears to be no record as to who can actually be credited for the observation that Douglas had another new species among his collections. It may have been

Douglas' own observation, or that of any other person associated with him. Whether this late finding was based on the pine material on the *Arceuthobium* sheet, or on the meantime three-years-old seedlings grown from the seed of ponderosa pine with which he had returned from North America (see below), shall probably also never be known; no written record appears to exist, either in archival material, or in the literature. *Pinus ponderosa* is a three-needled pine, while *P. resinosa* is two-needled; this difference should have been obvious in comparison with true *P. resinosa* material available to Douglas or any of the botanists studying his herbarium collection.

Early printed references to *Pinus ponderosa*

In view of the fact that by 1829 Douglas had clearly recognized *Pinus ponderosa* as something new, the question remains, why this new pine was not also taken up, and its specific status confirmed, by one or another of the professional botanists of the time?.

John Claudius Loudon, a garden architect with a strong interest in dendrology (SIMO 1988), is also intimately connected to the early botanical history of ponderosa pine. With the assistance of John Lindley, David and George Don and others, he edited a variety of horticultural journals and reference works, creating annotated enumerations of virtually all the plants known at the time. His works were primarily conceived for the use of land-owners and their gardeners (GLOAG 1970; MACDOUGALL 1980). It was in several of these reference publications that the botanical name *Pinus ponderosa* was to appear for the first time in print.

The earliest printed reference to the species appeared in the August 1830 issue of the 'Gardener's Magazine', one of LOUDON's journals (1830a, p. 506). This records the sale by auction of 230 three-years-old seedlings of *Pinus ponderosa* on 7 July 1830 at the Horticultural Society Garden to the London nurseries of Knight, Malcolm, Lee, Whitley, Tate, and Van Eden.

In August or in September of that year Loudon also published the first edition of his 'Hortus Britannicus' (LOUDON 1830b; see also the second edition, LOUDON 1832) as did also Robert SWEET a second edition of his book of the same title (1830). Both volumes achieved a very wide circulation, bringing many of Douglas' plants originally only known to the fellows of the Horticultural Society to the notice of the general gardening public; among them *Pinus ponderosa*, now readily available at several nurseries. The entry in LOUDON (1830b) does not describe it but contains an interesting annotation: In it, the editor points to LAMBERT's 'Description of the Genus *Pinus*', a new edition of which was then in preparation (LAMBERT 1832; 1837), presumably expecting that this very expert of the time on conifers would describe *Pinus ponderosa* along with other pines collected by Douglas. Lambert did not, however, describe or even figure *Pinus ponderosa* in either of these new editions;

probably because of the poor quality of the material available (the *Arceuthobium* infected specimen including an immature cone, and the very young seedlings), he did not feel confident in creating a new species.

Despite the lack of a published description, nurseries sold plants of *Pinus ponderosa* by the name they had bought these plants; the name appeared (again as an informal name, without description) in their catalogues (e.g. LODDIGES [autumn] 1830; MASTERS 1831; see also ANONYMOUS 1835b). It is likely that more similar references may yet come to light. These references testify to the high degree of acceptance this pine had achieved among horticultural circles of the time. Despite the absence of a formal description everybody appears to have known what was meant by *ponderosa* pine.

Plants of *ponderosa* pine were bought by a growing number of wealthy conifer enthusiasts who were obviously willing to risk the buying of expensive plants despite their uncertain scientific status. A later list of conifers in the collection at Dropmore (FROST 1833) for example includes it (see also MITCHELL 1972a and 1972b for late dates of introduction into other collections).

Nevertheless, again possibly as a result of no description being available and the apparent hesitancy of professional botanists to accept the new species, it appears that the plants may not have sold very well. LODDIGES (1836) and probably also LAWSON (1836, see below) still had now nine-years-old plants, and/or cuttings, for sale (grafts would be unlikely to have survived for any length of time). No other seeds of *Pinus ponderosa* or related taxa reached Britain for some time after Douglas (from C.T. Hartweg in 1847: see GORDON 1849; and from J. Jeffrey in 1853: see A. MURRAY 1853), so these later-sold trees cannot have been supplied by other origins. No indication exists that Douglas collected and sent either herbarium specimens or seeds of *Pinus ponderosa* to Britain from his third mission to North America between 1829 and 1834.

Another example of omission to take up the name *Pinus ponderosa* due to the scanty material may be found in W.J. HOOKER's 'Flora Boreali-Americana' (1829-1840). This reference work was intended to contain all North American plants known at that time, including those collected by Drummond, Richardson, Douglas, and others. While Hooker worked in Glasgow on the completion of his 'Flora', Douglas was absent on his third mission to North America. The botanist at Glasgow was obviously in a situation similar to that of Lambert and others, confined to Douglas' herbarium specimens and field notes, but without opportunity to consult him over them.

This results in the curious paradox that *Pinus ponderosa* is dealt with as the host of an *Arceuthobium* in the section on *Loranthaceae* (originally published as a separate in 1834, and included in volume one of the 'Flora'; see also treatment of the same subject in G. DON 1831-1838, vol. 3 [1834], p. 408), but in the section on *Pinus* is-

sued as late as 1838 and contained in volume two of the 'Flora', *Pinus ponderosa* receives no mention at all. Here HOOKER once more enumerates *Pinus resinosa* along with *Pinus lambertiana* ('Hab. Canada. - N.W. America, along with *P. Lambertiana*. Douglas' [p. 161]), showing that Hooker had not seen Douglas' manuscript 'Some American Pines'. Hooker was probably also misled by Douglas' inconsistency in the use of the new name in the abstracts of his journal completed in 1829. The confusion that already characterized the early botanical history of ponderosa pine is certainly due in part to the explorers own inaccuracy in this respect. Once again we see that a name now widely known among horticulturists escaped the notice of a professional botanist working only from herbarium material and field notes. The earlier stated absence of any separate *Pinus ponderosa* herbarium material is thus confirmed. Incidentally, Hooker's use of *Pinus resinosa* for *P. ponderosa* is the explanation for SARGENT's (1891-1902, vol. 11, p. 77, 1897) and several later author's citation of *Pinus resinosa* HOOKER (non SOLANDER in AITON) as a synonym for *Pinus ponderosa* (see below, the section on synonymy).

Chronology of early valid publication of *Pinus ponderosa*

Considering the reluctance of professional botanists to take up the new species, it was not by accident, that LAWSON (1836), a nurseryman, finally published a description of the species under the name *Pinus ponderosa*. Peter Lawson & Co. at Edinburgh, at that time run by son Charles Lawson, was among the most important nurseries of the time (MINAY 1991). Lawson's provision of a description was quite deliberate, as he notes the absence of and the need for one. Like other horticultural publications of its type, LAWSON's 'Agriculturists Manual' was however largely disregarded by the professional botanists of the time. 'Index Kewensis' (JACKSON 1893 ff.), for example, credits 'DOUGLAS in LOUDON, Arbor. Brit. 4: 2243' (1838b) as the first validly published botanical description of *Pinus ponderosa*.

LAWSON's 'Manual' was published in late June or early July 1836; the preface is dated May 10th, and it was reviewed on August 1st (LOUDON 1836b). On the other hand, LOUDON's 'Arboretum' as an entity (8 bound volumes) was officially published as late as 1st July 1838 (the preface is dated May 20, 1838; see advertisement in 'Allgemeine Gartenzeitung' 7, p. 39, 1839). In it LOUDON (1838b), in fact, already cites LAWSON's 'Manual' (vol. 4, p. 2243). But according to LOUDON himself (1838b, pref., p. VII) the 'Arboretum' was originally issued in 63 parts (68 parts according to ROBERTS 1936, and STAFLEU & COWAN 3, p. 171, 1981; see also LOUDON 1834), with repeated corrections, to subscribers between January 1835 and July 1838, and some parts must therefore predate LAWSON's 'Manual'. This matter had to be looked into, not only to definitely establish actual priority of publication, but also with regard to typification. Contrary to LAWSON (1836), whose description was exclusively

based on a then living tree, LOUDON (1838b) well cited Douglas' specimen of (*Arceuthobium* on) *Pinus ponderosa* and a holotype would in this case exist.

Individual issues of Loudon's 'Gardener's Magazine' (a journal at first published quarterly, later bimonthly, and again later monthly; an incomplete set of separate issues in their original paperback condition is held e.g. at the Botanical Library, University of Vienna, Austria) contain advertisement sheets in which Loudon offered advance parts of the 'Arboretum' for sale and subscription. In most cases the actual date of distribution of the numbered parts can be reconstructed, but their contents is never given. The same applies to the collection of ledgers recording the (financial) activities of the publishing house Longman, also distributors of most of Loudon's publications. The original records are housed at the University of Reading, Great Britain (the author has seen the microfilm edition held by the British Library, London, together with the [printed] 'Index to the [microfilm edition of the] archives of the House of Longman 1794 - 1914' compiled by A. Ingram, Chadwyck-Healey, Cambridge, 1981). Longman's ledgers record numbers and dates of distribution of advance parts, the number of copies distributed to unnamed subscribers, to anonymous journal-editors, and to specified reference-libraries, but again not the contents of any of the separates.

The Bodleian Library, Oxford, was one of the reference-libraries regularly recorded in Longman's ledgers as recipient of (mandatory copies? of) advance parts of Loudon's 'Arboretum'. Despite this, only the bound eight volume edition is available in Oxford and the historical catalogue listing all the acquisitions of this library in the relevant period also enumerates only Loudon's entire eight volume work of 1838 (BANDINEL 1843-1851, vol. 4). Searches in other important British libraries with a biological orientation, or with reputable antiquarians or auctioneers in Great Britain, to unearth either single separates or complete sets of advance parts of Loudon's 'Arboretum' have also all been unsuccessful to date.

A few of the probably rare references specifically indicating the contents of at least some of the advance parts of Loudon's 'Arboretum' have finally been traced in the 'Gentlemen's Magazine', a 19th century popular journal in Britain (e.g. ANONYMOUS 1835a,b; 1837a,b; 1838). One of these references (ANONYMOUS 1838) records the receipt of part-nos. 47 to 54, containing 'a most excellent and elaborate account of the various species coming under the genus *Pinus*, including pines, firs, cedars, larches, araucarias, etc..'. Longman's ledgers finally inform that parts 47 to 54 were issued between Oct. 31, 1837 and Jan. 30, 1838. It thus becomes firmly established that LAWSON's 'Agriculturists Manual' (1836) actually contains the chronologically first description of *Pinus ponderosa*.

Legitimate authorship of *Pinus ponderosa* and its quotation

A casual inspection of the taxonomically relevant literature on *Pinus ponderosa* reveals that opinions as to the proper author, and the way the authorship ought to be quoted, are still confused and need to be clarified. In the past this authorship has at various times been quoted in the following ways:

P.p. LOUDON (e.g. LINK 1841)

P.p. DOUGLAS in LOUDON (e.g. 'Index Kewensis', JACKSON 1893)

P.p. DOUGLAS (e.g. ANTOINE 1840; FARJON 1984)

P.p. DOUGLAS ex (P. & C.) LAWSON (or LAWSON & LAWSON) (e.g. SUDWORTH 1895; LITTLE 1979; KRAL 1993)

P.p. LAWSON (e.g. SUDWORTH 1898; LITTLE 1953)

P.p. LAWSON & LAWSON (or P. & C. LAWSON, e.g. KARTESZ 1994)

Since LAWSON's 'Agriculturists Manual' (1836) was thought to be mere ephemeral literature in earlier times and, therefore, was largely ignored by the professional botanists of the time, the entry for *Pinus ponderosa* in 'Index Kewensis' (JACKSON 1893 ff.: *P. ponderosa* 'Dougl. in Loud., Arboret. IV. 2243. f. 2132-2137. - Am. bor. occ.') is no surprise. SUDWORTH (1893) even plainly pointed out that Douglas never published a description of his own of *Pinus ponderosa*, and, therefore, that 'LOUDON' ought to be credited with the legitimate authorship of it. JEPSON (1893) fiercely refuted such an interpretation of the facts, arguing for the retention of 'DOUGLAS in LOUDON'.

Following the newly adopted American 'Rochester Code' of 1892 (FAIRCHILD 1892), which introduced the principle of priority of publication in the United States, SUDWORTH (1895) was the first to conclude that 'DOUGLAS ex LAWSON' (based on LAWSON 1836) was a more correct citation of authorship of *Pinus ponderosa* than the previously customary 'DOUGLAS in LOUDON' (based on LOUDON 1838b). Again later, SUDWORTH (1898) even entirely omitted Douglas' name from the quotation, crediting alone 'LAWSON' with the authorship.

Sudworth's argumentation seems to have been taken up by LITTLE (1948), who also concluded: 'The mere mention by Lawson that Douglas introduced the species is not sufficient to credit him as author of his epithet'. This resulted in the entry '*Pinus ponderosa* LAWSON' in the then forthcoming 'Check list of United States trees' (LITTLE 1953). In a revised edition of this 'Check list', LITTLE (1979) again reverted to 'DOUGLAS ex LAWSON', but the reasons for this change of mind have never been detailed.

Concerning citation of authorship the current ICBN (GREUTER & al. 1994) is explicit. Since the 'Agriculturists Manual' of 1836, which actually contains the first valid description of ponderosa pine, was obviously edited by Charles LAWSON, at that time the sole proprietor of the firm Peter Lawson & Co. (MINAY 1991), the authorship ought to be quoted *Pinus ponderosa* C. LAWSON. However, it is safe to assume that Douglas (perhaps with the aid of some person in command of botanical Latin) personally coined the epithet '*ponderosa*'. No other person but Douglas with his field experience could have chosen this particular name. It was Douglas who documented his late discovery with a re-determination of the host on his specimen of *Arceuthobium* on *Pinus resinosa* in 1829. It is based on this late discovery, and long before a validating, scientific description was available, that plantlets grown from the seeds received through him were sold as DOUGLAS' *P. ponderosa* in 1830, to several British nurseries, and through them thereafter to the general public (acknowledged in e.g. LOUDON 1830b; SWEET 1830). If the nurseryman Lawson ever had wished to get credited with the authorship for finally publishing as late as 1836 a long wanting description of ponderosa pine, his action would at once have rightly been termed untruthful and unjust to Douglas 'and he would have laid himself open to the charge of piracy' (JEPSON 1893).

Considering all circumstances pertaining to the explorer and his time, including his celebrity which was obvious already during his lifetime (LOUDON 1836e), it becomes evident that Lawson's omission to explicitly credit Douglas with the discovery, at a time when many modern formal requirements were not yet mandatory, was merely accidental. Again in agreement with the ICBN, these circumstances all advocate for doing justice to Douglas by retaining his name in quoting legitimate authorship of ponderosa pine as follows: *Pinus ponderosa* DOUGLAS ex C. LAWSON, *Agriculturists Manual*, 354: 1836.

Again no record appears to exist to document Douglas' motive for choosing the epithet '*ponderosa*' (the correct declension derived from the Latin '*ponderosus*'). In the manuscript 'Some American Pines' (drafted in 1829), DOUGLAS (1914, p. 345) characterizes the wood of ponderosa pine as being 'remarkably clean-grained, though somewhat coarse in texture, smooth, heavy, reddish, works fine, and is impregnated with a copious rosin'. Heaviness of the wood is not emphasized in any way. In the same manuscript the trees of this species are termed 'tall, straight, ..., very elegant, ninety to one hundred and thirty feet high, sometimes exceeding four feet in diameter, three feet above the ground, carrying their thickness to a very great height ...'. One plausible interpretation would be that Douglas intended to characterize the majestic, 'ponderous' appearance veterans of this species attain in their native habitat in western North America. Obviously from hearsay, LAWSON stated in 1836 that the epithet '*ponderosa*' is an allusion to the 'timber, said to be so ponderous as almost to sink in water'. Although the wood of *Pinus ponderosa* is commonly known to be comparatively, or moderately light in weight (KOTOK 1973; UNITED STATES FOREST

PRODUCTS LABORATORY 1974), Lawson's interpretation has remained the accepted etymology of Douglas' name ever since.

Relevance of Douglas' type locality and specimen

Based on HOOKER's (1836) account, many both older and recent local and regional floras of western North America (e.g. SMITH & WHEELER 1992, for only one of the most recent such publications) time and again indicate the vicinity of Spokane, Washington, as the type locality for *Pinus ponderosa*. However, this locality is not cited by LAWSON (1836) and although it is located within the general area explored by Douglas, it cannot be regarded a priori as the type locality.

Since *Pinus ponderosa* was misidentified in the field, Douglas would not have felt the need to collect a herbarium specimen of it. Indeed, a specimen of it from near Spokane, Washington, never existed as such; earlier reports of such a specimen having existed in Douglas' Herbarium at the Horticultural Society of London (LOUDON 1838b, vol. 4, p. 2243) and later at Kew (ELWES & HENRY 1906-1913, vol. 5 [1910], p. 1075) are inexact, and have mislead many later workers attempting to relocate it. What ought to exist is a specimen of *Arceuthobium* on *Pinus resinosa* collected in 1826, probably with the pine name corrected to *Pinus ponderosa* in 1829, when it was realized to be a new species.

This is indeed the case, and the author located this specimen at Kew in 1992. It is not filed under *Pinus*, but as should be expected, under *Arceuthobium* (*A. campylopodum*). The specimen appears to have been remounted several times since its deposition in the Hooker Herbarium, and is currently arranged on a single sheet with a variety of other *Arceuthobium* specimens from various sources. It consists of a small *Pinus ponderosa* shoot under obvious *Arceuthobium* infection stress with only a few fully developed needles of the previous season; due to the collection in early May, the new shoot of the year is not fully expanded. The specimen is annotated in Hooker's hand (upon remounting the specimens, after these had been purchased for Kew in 1856) with the comment 'Parasitical on *Pinus ponderosa*, Amer. boreali ou. Douglas 1829', indicating that the material was realized to represent a new species, and the name *Pinus ponderosa* was coined, sometime in 1829. The scanty nature of this specimen may account for its never having been illustrated; figure 2137 in the section for *Pinus ponderosa* in LOUDON (1838b, vol. 4, p. 2246) shows Douglas' much better material of *Arceuthobium* collected on *Pinus contorta* (as *P. banksiana* !) which is also preserved among *Arceuthobium* at Kew. The immature cone of ponderosa pine also collected in May (!), known to have existed in the past and (unlike the vegetative *Arceuthobium*-infected specimen) well figured in LOUDON (1838b, vol. 4, p. 2244, fig. 2134), FORBES (1839; here together with a shoot from the tree then grown at Woburn Abbey) and ANTOINE (1840) has not been located and is now probably lost.

As this *Pinus ponderosa* specimen on the *Arceuthobium* sheet was not cited in LAWSON's description (1836), it cannot be regarded as the holotype; it is only an interesting historical specimen with no relevance to the identity of the species. The same applies to a specimen (a single fascicle of needles of *Pinus ponderosa*) at MO marked 'ex K'. George Engelmann toured through Europe and visited its main herbaria in 1868 and 1869 (WHITE 1902). On that occasion, as is evidenced by specimens today present in his collections (some of which are actually dated 1869), he obviously received fragments of (type ?) material (needles) of several pine taxa for comparative studies at home: e.g. of *Pinus craigana* A. MURRAY (q.v. in the synonymy), and obviously also from Douglas' specimen of *Arceuthobium* on *Pinus ponderosa*.

The description by LAWSON (1836) was based on plants grown from Douglas' seeds of this species in Britain (in the garden of the Horticultural Society of London), mainly from a young tree of the same origin transplanted to, and at the time growing at the Caledonian Horticultural Society garden (now part of Royal Botanic Garden, Edinburgh: FLETCHER & BROWN 1970). Lawson did not indicate a type. The tree from which Lawson's description was made no longer exists (as indicated by the author's vain searches in Edinburgh), and a search of all possibly relevant herbaria (BM, CGE, E, K, OXF) revealed no herbarium material from it, so no lectotype can be chosen.

Although LAWSON's (1836) description certainly fulfills all the formal requirements of the ICBN (GREUTER & al. 1994), it is also very scanty by modern standards, lacking any information about the cones that are so important to the characterization of *Pinus* species; the details provided, from an eight-year-old tree, could also apply to some other North American three-needled pines and are not suited to unequivocally identify Douglas' *Pinus ponderosa*. Searches to unearth authentic material better suited to identify and typify ponderosa pine had therefore to be continued.

In a logically next step, the origin of Douglas' seeds, from which also Lawson's tree was grown, had to be determined. Douglas was not very informative in this respect, but did state that he did not personally collect it (DOUGLAS 1914, p. 205):

'...August 15th, 1826... By the 15th found seeds of most of the plants around Kettle Falls; except four species of *Pinus*, a note of which I have made to Mr. Work, to gather them for me in October. ...'.

The entries in Douglas' journal covering the area around Fort Colville, Kettle Falls (DOUGLAS 1914, p. 162-205 and 247 ff.) allow the inference that these four 'pines' comprised *Pseudotsuga menziesii* (Douglas' '*Pinus taxifolia*'), *Larix occidentalis* ('*Pinus larix*'), *Pinus contorta* ('*P. banksiana*'), and *Pinus ponderosa* ('*P. resinosa*'; in Douglas' time all *Pinaceae* were often still included in the single genus *Pinus* as circumscribed by Linnaeus).

John Work was a travelling trader for the Hudson Bay Company, and also kept accurate diaries. Unfortunately, only an incomplete set survives today (ELLIOTT 1912; 1914a,b,c; 1915 and other mainly unpublished manuscripts); the diary for October 1826, particularly important in the present context, is among those missing (D. Mattison, Archivist, British Columbia Archives, Victoria, B.C., pers. comm. 1992). On 15 September 1826, John Work was at Fort Colville and preparing to set out for an unspecified length of time to explore the Pend Oreille River (ELLIOTT 1915). The Forts of the Hudson Bay Company also kept journals documenting the activities of their personnel, but again, the Fort Colville journals for the relevant period (October 1826) appear to be lost (J.H. Beattie, Keeper, Hudson Bay Company Archives, Winnipeg, Manitoba, pers. comm. 1992).

In conclusion, John Work may have collected the requested seeds of *Pinus ponderosa* somewhere on Pend Oreille River, or he may have returned in time to collect them at Kettle Falls, or possibly elsewhere on his travels. It is not now possible to determine where from historical evidence. In view of the currently ambiguous taxonomic status of ecotypes, morphotypes and races of *Pinus ponderosa* s.l., and in view of the still unverified status of other sympatric taxa currently considered to be synonyms of it, or closely related to it (e.g. *Pinus washoensis*, see introduction), the mere collection of a neotype in only the general area explored by Douglas is not the correct course of action to typify it. The identity of the species must be determined by other means.

The identity of *Pinus ponderosa* DOUGLAS ex C. LAWSON

Douglas met John Work again at Kettle Falls in April 1827 on his return trip overland to Hudson Bay (DOUGLAS 1914, p. 246) and it is presumed here that Work on this occasion handed over to Douglas the seeds he was able to gather in October of the previous year. Douglas, on his return to London in October 1827, among other species indeed brought to Britain seeds of *Pinus ponderosa* and *Pseudotsuga menziesii*. Some of the plantlets raised from these seeds were distributed among the fellows of the Horticultural Society (FORBES 1839, p. 45; GORDON 1872). It is the remaining plantlets of these species that were finally sold by auction to British nurseries (LOUDON 1830a), and through them to the general public, including Lawson's tree grown at Edinburgh.

A number of veterans purportedly grown from this seed still survive in British arboreta, including some *Pinus ponderosa* (MITCHELL 1972a; 1972b). In order to avoid any confusion with other old trees of ponderosa pine not actually originating from Douglas' seeds (C.T. Hartweg collected in California in 1846 and 1847, John Jeffrey, William Lobb and others in the 1850ies), only veterans well documented to have been planted prior to about 1845 have been considered here. Additional sources of

information potentially documenting these early plantings have been consulted wherever possible (many of them are well listed in DESMOND 1984).

Of the potentially relevant veterans of *Pinus ponderosa* listed in MITCHELL (1972a; 1972b), the trees in Bicton, Leighton Hall (A.F. Mitchell, pers. comm. 1992) and Bowood (the writer's own inquiries) had succumbed by 1992, either to the storms of 1987, or to the effects of other agencies.

Several of the relevant characteristics of the other veterans examined by the author in the spring of 1992 have been measured (diameter at breast height [dbh] in cm) and/or photographed (the trees, their bark, cones, etc...). Bits of bark have been picked, and also some needle-material from the ground beneath the trees (often not in a satisfactory state of conservation). However, in all cases (often admittedly very small) samples of fresh needles have been secured and 'permanently' conserved in fixing solution. Of most of the trees, one to several ovuliferous cones (most of them in an advanced state of weathering) have been found. Material for study and/or photographs are available from the author at [W]. For detailed addresses of places named below, see MITCHELL (1972a; 1972b. But proprietors have changed in several cases).

Arley House: The gardens at Arley House (formerly Arley Castle) have a long history. The arboretum was started in 1800. The planting of exotic trees continued till about 1844 and was later resumed, with substantial additions to the collection between about 1852 to 1882 (SIDWELL 1981). But 19th century records documenting these early plantings have not been found. In 1907 WOODWARD recorded two trees of *Pinus ponderosa* growing in the arboretum: No 51, in 1903 measuring 6 ft. 8 in. in girth at breast height (corresponding to about 65 cm diameter, or dbh); and No 200, 7 ft. 8 in. in girth (c. 75 cm dbh), both planted in 1820 (?). ELWES & HENRY (1906 - 1913, vol. 5, p. 1076) also mentioned these two trees with the date of planting corrected to 1829.

In 1961 the two trees recorded in MITCHELL (1972a; 1972b) both measured 74 cm dbh. In 1992 the only surviving large tree of *Pinus ponderosa* (new No 390) did not exceed 80 cm dbh (the fate of the other tree is unknown). An immature cone collected from that tree in June 1992 was purple, near cylindrical to elongated-conical in shape, and 84 x 41 mm in size, when fresh. Mature, open cones, of russet colour, range from ovoid to elongated in shape and from 70 x 60 mm to 87 x 73 mm in size.

Bayfordbury: The pinetum 'which is justly celebrated' (CUSSANS 1870-1881) was begun in 1837 by W.R. Baker (BOASE 1908; CLINTON-BAKER 1909, vol. 1, Introduction). It was first mentioned by LOUDON (1840). In an editorial contribution in the 'Gardeners Chronicle' (ANONYMOUS 1885) an overview of the comprehensive collection of already large conifers growing at Bayfordbury has been presented. In 1872, GORDON explicitly named this estate as one of the (few) places to which Douglas' plants of *Pinus ponderosa* were sent. Later, GORDON (1909) was impressed

by a tree of ponderosa pine planted there in 1838 which had attained the following dimensions in 1909: 100 ft. high and 9 ft. 7 in. in girth (which corresponds to about 95 cm dbh). In 1909, H. CLINTON-BAKER, son of W.R. Baker and heir to Bayfordbury edited 2 volumes of illustrations (foliage and cones) of (most of) the conifers then growing at the pinetum. According to this publication 'a' tree of *Pinus ponderosa* was in 1906: 100 ft. high by 9 ft. 4 in. in girth. ELWES & HENRY (1906 - 1913, vol. 5, p. 1075) recorded the history of 'a' tree of *Pinus ponderosa* (planted in 1837 !) in more detail:

It measured

in 1865, 4 ft. 9 in. in girth

in 1900, 9 ft.

in 1906, 100.5 ft. tall and 9 ft. 4 in. in girth, and

in 1909, 101 ft. in height and 9 ft. 7 in. in circumference.

CHITTENDEN (1932, p. 326 and 425-426) recorded 'one' tree at Bayfordbury, 'the tallest of ponderosa pines for which returns have been received for the 1931 conifer conference statistics' with the following dimensions: 108 ft high, 10 ft. 4 in. in girth (about 100 cm dbh). Finally, MITCHELL (1972b, p. 234; see also 1972a) stated the following details: 'The original tree [of *Pinus ponderosa* grown from Douglas' seeds] at Bayfordbury noted by Elwes and Henry is taken to be the one that was blown down in 1951 when 124 ft. x 11 ft. 0 in. but another there is now of larger girth [in 1962: 93 ft. tall and 11 ft. 10 in. in girth (about 115 cm dbh, 118 cm in 1968)] and may well have been planted at the same time'. Curiously, when the author visited the (already very neglected and largely overgrown) 'pinetum' at Bayfordbury in June 1992, two very large, quite healthy veterans of *Pinus ponderosa* s.str. (136 and 110 cm dbh respectively) were growing only a few dozen meters apart (and a few younger trees obviously planted at a later date grew nearby). Thus, the large tree of *Pinus ponderosa* purportedly blown down in 1951 could well also have been the *Pinus benthamiana*, or the *P. parryana* (introduced to England in 1847 and around 1855 respectively and currently considered to be synonyms of *Pinus ponderosa*) which are variously reported to have been present among the collections of conifers at Bayfordbury (ANONYMOUS 1885; 1909). Despite minute searches, no cones could be found in the dense thickets of ferns covering the ground beneath both old veterans. Only one small, immature cone could be discerned (by binoculars) high up in the crown of the larger tree.

An ovuliferous cone of '*Pinus ponderosa* Dougl.' collected in this place nevertheless exists. As evidenced by the appended label it was gathered in 'Bayford - Bury January 2^o - 1849'. It is a small, mature and open cone (88 x 74 mm), ovoid in shape, with thin scales of a characteristic russet colour and small, flat apophyses. Also the umbo is generally flat with a sharp mucro. It was discovered in a historical cone collection surviving as part of the carpological collection of the Natural History

Museum in Vienna, Austria [W]. Collected in 1849, this cone obviously originates from (one of) the tree(s) of *Pinus ponderosa* confirmed to have been planted at Bayfordbury as early as 1838 (GORDON 1909), and known to have been grown from Douglas' original seed-lot sown in 1828 (GORDON 1872); it can therefore safely be termed 'authentic'. The authors vain searches in England to unearth original material of ponderosa pine show, that this cone very likely is the oldest such material available in any herbarium anywhere.

Another specimen (only wrapped in paper and not yet mounted on a sheet), kept in the same collection at [W], the fragment of a twig (260 mm long, about 17 mm thick), with some needles (220 mm long) and (two) ovuliferous cones still attached to it, bears a label: '*P. ponderosa* Bayford - Bury', obviously written by the same hand as the text on the other label. The two mature, open cones (82 x 77 and 86 x 73 mm) physically match the single cone described above. This richer specimen could give a good impression of the botanical characteristics of *Pinus ponderosa* s.str. However, although all circumstances indicate that this specimen also originates from the same source (probably even collected from the same tree and at the same time as the other specimen), it can probably not be termed 'authentic' with the same certitude, since no date of collection is stated on the label.

Another single (tightly tied up, closed) cone (98 x 47 mm) has a label stating: '*Pinus ponderosa* from Low, see Low's letter about it. Janu. 1848.'. Unfortunately the letter alluded to (probably from Hugh Low of Messrs. Hugh Low & Co., nursery firm at Clapton, see DESMOND 1977) is missing. Although certainly not originating from ponderosa pines at Bayfordbury, this cone nevertheless also demonstrates the purposefulness of the formation of the historical collection at [W] and moreover confirms its old age. The specimens described above, and in the next section, are not just objects that have got into this collection merely by accident.

Bury Hill: CHITTENDEN (1932, p. 326 and 331-333) mentioned a tree planted in 1840 and measuring 98 ft. in height by 9 ft. 1 in. in girth (about 88 cm dbh) in 1931. An earlier source (ROBSON 1865) well documents the existence of a pinetum at Bury Hill, and although *Pinus ponderosa* is not explicitly enumerated, this publication nevertheless records several other species of conifers planted in about 1840. According to MITCHELL (1972b) the tree mentioned by CHITTENDEN (1932) was planted in 1834 and in 1971 had attained a height of 100 ft. and 9 ft. 3 in. in girth (about 90 cm dbh; MITCHELL 1972a). In 1992 the one tree of *Pinus ponderosa* present on the grounds (a large tree by far surpassing all neighboring broadleaved trees in height) had only attained 93 cm dbh but its bark was clearly beginning to adopt a structure (large plates and shallow fissures) reminiscent of ('over-mature') ponderosa pines at old age. Immature cones were seen by the writer to be dark purple. The few entire, badly weathered mature cones found beneath the tree are ovate to elongated in shape and range from 85 x 60 mm to 90 x 70 mm in size.

Dawyck: Based on written records in his possession, BALFOUR (1925, p. 79-80), then proprietor of the place, gave an account of the history of Dawyck and of the dates of introduction of several exotic species of trees planted on the estate. From this account (see also BALFOUR-GOURLAY 1947) it can be learned that it was Sir John Naesmith (1803-1876) who (among other species of trees) first planted *Pinus ponderosa* in Scotland and that he was greatly assisted in his ornamental planting operations at Dawyck (between 1829 and 1876, but for the most part between 1835 and 1865) by Lawson, the famous Edinburgh nurseryman.

CHITTENDEN (1932, p. 485-492) recorded a *Pinus ponderosa* thought to have been planted in 1839 (but he misidentified it as a *Pinus ponderosa* var. *jeffreyi*, see also BALFOUR 1932, p. 196), a tree which in 1931 was 65 ft. tall and 7 ft. 10 in. in girth (about 76 cm dbh). According to MITCHELL (1972b) the dimensions of this tree, planted in 1837 (in 1838 according to MITCHELL 1972a) were in 1966: 105 ft. by 9 ft. 5 in. (about 92 cm dbh). In June 1992 this tree (decidedly a *Pinus ponderosa* s.str.) measured 111 cm dbh. The only, badly weathered cone found beneath the tree is ovoid elongated in shape and measures 90 x 70 mm.

Dropmore: The oldest authentic account documenting the early planting of a *Pinus ponderosa* is that by FROST (1833), famous head-gardener at Dropmore until his death in 1887. Because Dropmore was at this time already well-known as outstanding among British, and even European pineta (LOUDON 1838a), notable trees among its collections have been recorded and measured more frequently than veteran trees from elsewhere. These earlier measurements and the detailed history of Dropmore and its pinetum (scattered in a multitude of cited and a few omitted sources [e.g. several references in LOUDON's journal 'Gardener's Magazine' between 1828 and 1842; GORDON 1872]) have been quite comprehensively summarized by MITCHELL (1963). Of the three veterans of *Pinus ponderosa* recorded in this publication one (the tree mapped in E 15) can be termed 'original' (i.e. one of Douglas' seedlings planted in 1829). Another tree, listed in MITCHELL (1963, mapped in K 21) as purportedly planted in 1843, probably corresponds to the tree recorded by HERRIN (1892) as *Pinus benthamiana* (a species introduced to Britain by Hartweg in 1847). This tree is excluded from the present considerations, as is still another tree of *P. ponderosa* mentioned in MITCHELL (1963, mapped in K 11) and planted at an unknown date (both these trees of the K-plot were missing in 1992 and had probably succumbed to the storms of 1987). In 1970 the 'original' *Pinus ponderosa* at Dropmore was 98 ft. tall and 9 ft. 10 in. in girth, or about 95 cm dbh (MITCHELL 1972a; 1972b). In 1992 the present author found this tree still in good health and measuring 97 cm dbh. Several quite weathered cones found beneath this tree are ovoid to elongated in shape and from 75 x 65 mm to 95 x 70 mm in size.

Eastnor Castle: The arboretum in the castle grounds contains a large and varied collection of conifers (listed in ADAMS & al. 1977; FRICS 1982) mainly planted

between 1840 and 1860 (MULLINS 1903; SIDWELL 1981, p. 51). BARKER (1888) already documented the presence of 'large and handsome trees' of *Pinus jeffreyi*, *P. ponderosa* and *P. benthamiana* at Eastnor. ELWES & HENRY (1906-1913) mentioned two trees of *Pinus ponderosa* both 65 ft. high and 7 ft. (about 68 cm dbh) and 8 ft. 4 in. (c. 81 cm dbh) respectively in girth. CHITTENDEN (1932, p. 411) only recorded a *Pinus benthamiana* measuring 85 ft in height to 10 ft. in girth (c. 97 cm dbh). According to MITCHELL (1972b) the larger tree mentioned in ELWES & HENRY (1906-1913) had grown to a height of 105 ft. and a girth of 10 ft. 8 in. (104 cm dbh) in 1970. Confusingly, however, it is another tree, obviously CHITTENDEN's (1932) *Pinus benthamiana* which, according to MITCHELL's companion publication (1972a), had attained these very same dimensions in 1970. MITCHELL (1972a) specified 'NW of drive' as the location of this tree among the collections, which obviously corresponds to the tree recorded in ADAMS & al. (1977, p. 6 and mapped 'west of church walk'), a tree then having attained 32 m in height and 330 cm in girth (c. 105 cm dbh).

In 1992 this (largest?) tree of ponderosa pine was obviously no longer there. The present author was shown a healthy tree of *Pinus ponderosa* (90 cm dbh) on top of a small hill next to the 'Summerhouse', a site already mentioned in BARKER (1888): '[On] Summerhouse Hill we find ourselves in the midst of conifers of all kinds and of exceptional size'. A mature, open cone shot from the tree is russet in colour, ovoid in shape and 80 x 65 mm in size. In a cursory inspection of other parts of the park much speeded up by heavy rain and lack of time, the writer saw two more large(r) ponderosa pines of unknown history and age growing along 'Summerhouse walk' (102 and 73 cm dbh respectively, the trees are also mapped in ADAMS & al. 1977, and in FRICS 1982).

Highnam: According to MITCHELL (1972b) a *Pinus ponderosa* was planted at Highnam as early as 1844 (1846 according to the companion publication, MITCHELL 1972a), but no other record confirming this early date could be found. This tree is further said to have been 5.5 m tall in 1856 and 10.2 m in 1862 (MITCHELL 1972a). ELWES & HENRY (1906-1913) reported its dimensions in 1909: 72 ft. tall and 9 ft. 4 in. in girth (about 90 cm dbh). In 1970 this tree was 85 ft. high and 12 ft. 11 in. in girth (125 cm dbh; MITCHELL 1972a; 1972b). In 1992 the writer found three large *Pinus ponderosa* s.l. growing on the grounds. One of the trees (75 cm dbh) appears to be much younger than the other two trees. In its morphological traits (e.g. its large cones) one of the two older trees (127 cm dbh) could correspond either to the *Pinus benthamiana* HARTWEG or to the *P. parryana* GORDON (named after T. Gambier-Parry, proprietor of the place in the 1850ies) documented to have been planted at Highnam Court (ANONYMOUS 1855; 1892). Both these taxa, Bentham's and Parry's pine, introduced to England in 1847 and around 1855 respectively, are currently considered to be synonyms of *Pinus ponderosa* s.l. The third tree is decidedly a *Pinus ponderosa* s. str. (115 cm dbh). Six cones selected (from the rather weathered

cones found beneath the tree) to demonstrate the full range of available sizes, are from globose-ovoid to ovoid-elongated in shape and from 75 x 62 mm to 104 x 80 mm in size.

Powis Castle: The history of planting at Powis is not exceedingly well documented. MITCHELL (1972b) only doubtfully dated to 1829 the introduction of *Pinus ponderosa* to the Powis castle grounds. The oldest record known is that of ELWES & HENRY (1906-1913) who gave the dimensions of the *Pinus ponderosa* 'near the Welshpool entrance to the park' in 1908: 105 ft. tall and 10 ft. in girth (97 cm dbh). Although other notable trees growing at Powis were indeed recorded, CHITTENDEN (1932, p. 446) did not mention any *Pinus ponderosa*. MITCHELL (1972a; 1972b) for the first time recorded all three veteran ponderosa pines actually present on the grounds, with the following dimensions in 1970 (trees 2 and 3 are outside the public area):

1) Below Castle, near Welshpool entrance:	37.5 m	tall	127 cm	dbh
2) Opposite Gwen Morgan's wood:	36.0 m	"	99 cm	"
3) 'Rabbit Bank' beyond G. Morgan's wood:	39.0 m	"	136 cm	"

Dimensions recorded by the writer in 1992 were: 139 cm dbh for tree 1, 104 cm dbh for tree 2 (declining and perhaps even dying), and 154 cm dbh for tree 3. Immature cones from trees 1 and 2 were dark purple (colour of cones from tree 3 remained unknown). One immature cone gathered from tree 2 is near cylindrical to elongated-conical in shape and was 87 x 42 mm in size, when fresh. Form and dimensions of mature (usually quite weathered) cones found beneath the trees are as follows: Globose-ovoid (one cone 85 x 67 mm) to elongated (two cones 96 x 67 mm and 90 x 70 mm) from tree 1. Ovoid (one cone only, 75 x 60 mm) from tree 2, and globose-ovoid (one cone only, 92 x 80 mm) from tree 3.

Neotypification of *Pinus ponderosa* DOUGLAS ex C. LAWSON

Ranked according to conclusiveness of sources documenting their history, and according to size (dbh), the following veterans of ponderosa pine may safely be assumed to be 'original' trees grown from Douglas' seed:

- 1) Bayfordbury
- 2) Dropmore
- 3) Dawyck
- 4) Highnam Court, one large *Pinus ponderosa* s. str.
- 5) Bury Hill
- 6) Arley House
- 7) Powis, trees 1 and 3 (?)
- 8) Eastnor Castle, tree on 'Summerhouse hill' (?)

Presumably having originated from the same seed lot from which Lawson's tree was grown, the veterans of *Pinus ponderosa* listed above were expected, and were indeed also found, to all be quite homogeneous in their botanical characters and, therefore, closely comparable (with the exception of some of the trees seen in Eastnor and Highnam this in fact applies to virtually all other veterans of ponderosa pine seen by the author in Great Britain in 1992).

Despite the presumed 'originality' of all these living individuals of ponderosa pine, the ovuliferous cone collected in Bayfordbury in 1849 and discovered in the historical collection of conifer cones in [W] can much more safely be termed 'authentic' than any of the material collected from living trees in 1992, or some 150 years later. The safety of this assumption is further corroborated by the fact that this historical cone at [W] closely matches in physical characteristics the ovuliferous cones collected by the author in 1992. This makes this historical cone at [W] an adequate candidate for correctly typifying *Pinus ponderosa* Douglas ex C. Lawson.

Vienna's main conifer herbarium was destroyed in a fire accident in 1945 (PETRAK 1948). Only a historical collection of conifer cones as part of the carpological collection remains. The core of this cone collection was obviously assembled in the 1840ies and independently of the main conifer herbarium, probably as Stefan Endlicher's (originally private) reference collection. Although there have been additions in more recent years, the collection is still mainly in a pristine, unrevised state. The labels appended to the various specimens leave no doubt as to their age (actually stated on some), and often indicate names of various little-known historical collectors (most of whom are, however, well listed in BARNHART 1965). Labels on other pine cones not readily available from the wild in Endlicher's time, indicate sources like 'Jardin des Plantes, Paris', or 'Hort. Soc.' (now Royal Horticultural Society, London). Another cone, a *Pinus montezumae*, has an attached label stating: 'From this cone Mr. Lambert made his figure'. Some taxa of *Pinus* have already been (lecto-) typified with ovuliferous cones from this collection (FARJON 1995; LAURIA 1996). More typifications based on the same material at [W] are in preparation (FARJON, oral communication 1994). *Pinus ponderosa* is another pine which is herewith (neo-) typified with authentic material from the same collection.

Pinus ponderosa Douglas ex C. Lawson, Agric. Man. 354 (1836).

Neotype, here designated [W]: One ovuliferous cone with appended label stating: 'Bayford - Bury January 2° - 1849' (see fig. 1).



Fig. 1: Neotype-cone of *Pinus ponderosa* DOUGLAS
ex C. LAWSON

According to this neotype-cone, and to all other 'authentic' material documented in the previous section, *Pinus ponderosa* s.str., as meant by Douglas and described by LAWSON in 1836, can be characterized as follows: A tree of up to 40 m high, or more, and up to 155 cm (or more) dbh. On almost all trees seen the bark was quite uniform in structure, very thick, unevenly split by a multitude of deep vertical fissures, and with the surface in different shades of a light brown. Contrary to this the bark-fissures of the tree at Bury Hill were rather shallow and the tree was also unique among all the veterans seen in having a bark that was beginning to form large(r) size plates characteristic of veterans of ponderosa pine.

Needles are in fascicles of three and from 160 to 260 mm long (in general 160 to 220 mm). Immature ovuliferous cones are probably all deep purple (pigmented cones from several trees documented with photographs), near cylindrical towards the base, long-conical at the apex, sometimes slightly curved and measuring about 85 x 40 mm when fresh (average from very small sample). Mature open cones quite symmetrical to slightly curved, some basal scales almost always missing, russet in colour or dull grey when weathered, relatively small (in sample gathered in England ranging from 75 to 96 mm in length and from 60 to 80 mm in width), globose-ovoid or ovoid to elongated in shape, of relatively low density (exception: cones from Powis 1 and 3 are distinctly more woody and heavier), and possessing from about 70 to some 110 fertile scales (and a phyllotaxis of 8/13 easily perceptible parastichies).

Cone scales are generally thin and brittle; apophyses have a more or less rounded upper margin, are quite flat to slightly elevated (in cones from Powis 1 and 3 they are more woody and quite evenly elevated on both sides of the transverse keel), and are from 15 - 19 mm broad. The umbo is normally flat (in some cones there are some salient umbos) with a stout, more or less narrow-triangular mucro which normally is pointing outward (centromucronate sensu KLAUS 1980). Umbo and mucro are usually well differentiated, but sometimes the umbo is more or less gradually blending into a mucro (in cones from Dropmore and Highnam).

Synonymy

Pinus ponderosa, *P. engelmannii*, *P. jeffreyi*, *P. arizonica* and (the doubtful) *P. washoensis* are the five species currently considered to form the 'ponderosa complex' (sensu MIROV, 1967, p. 558). Like *P. ponderosa*, none of these taxa has ever been comprehensively revised. Practically all of them, including a plethora of synonyms, have experienced a chequered, intricate taxonomic history. All names known to ever have been connected to any of the members of the ponderosa complex are therefore included in the following enumeration, in alphabetical order of specific or infraspecific epithets. These epithets have practically all at one time or another been placed in synonymy, either to *Pinus ponderosa* itself (including its infraspecific entities), or to one or several of the other members of the 'ponderosa complex'. In view of this it is not now possible to clearly separate synonyms of *P. ponderosa* (and its infraspecific entities) from those probably appertaining to other species of the complex. As long as their (in some cases not yet located, in other cases absent) nomenclatural types have not been compared, any final statement of affiliation would be conjectural and premature. Statements to this effect in the enumeration below are therefore all only of a tentative nature.

'ambigua'

Pinus jeffreyi var. *ambigua* LEMMON, Revision of broken-cone pines. Calif. State Board Forest. Bull. 7: 11 (1889).

Pinus jeffreyi var. *montana* LEMMON, Handb. West-Amer. Cone-Bearers (ed. 3), 35 (1895).

Type: United States, Montana, valley of Flathead Lake. According to 'Index Herbariorum' (CHAUDHRI & al. 1972), Lemmon's types are supposed to be at UC. However, apart from an unprocessed 'backlog' where some Lemmon specimens might still be hidden, inquiries to locate type material of this taxon have been unsuccessful to date.

A type of this taxon probably never existed. An over-zealous John Gill Lemmon presumably coined this name solely based on a 'Note' by Wm.M. Canby and C.S. Sargent appended to the enumeration of *Pinus ponderosa* in the 'Report on the Forests of North America': 'A form with purple cones and long glaucous foliage, ap-

proaching *P. jeffreyi* in habit, is the prevailing tree of the valley of Flathead lake, Montana' (SARGENT 1884, p. 193).

Although not stating his motives, but perhaps to conform to the newly adopted American 'Rochester Code' of botanical nomenclature (FAIRCHILD 1892), LEMMON later (1895, p. 35) substituted the name of his *Pinus jeffreyi* var. *ambigua* with the new name *P. jeffreyi* var. *montana*. The new name is obviously an allusion to the type locality; LEMMON (l.c.) clearly refers to the same population of *Pinus ponderosa* s.l. earlier circumscribed as *Pinus jeffreyi* var. *ambigua*, and in accordance with the current ICBN (GREUTER & al., 1994), 'var. *montana*' is therefore only a synonym of the former.

A decision as to the status of this taxon must necessarily await the collection of a neotype in Flathead Lake valley, Montana.

'*apacheca*'

Pinus mayriana var. *apacheca* (LEMMON) LEMMON, Handb. West-Amer. Cone-Bearers ed. 4: 112 (1900).

Pinus apacheca LEMMON, Erythea 2: 103, plate 3 (1894).

T y p e : 'United States, Arizona, Chiricahua Mountains, May 1892', J.G. Lemmon [UC 336766].

A sterile specimen. As stated in the protologue, Lemmon collected specimens in August 1881, and again in June 1892. According to a label appended to the above specimen, there are several other sheets in the Lemmon collection at [UC], although not any dated 1881. The above specimen doubtlessly constitutes original material.

According to LEMMON (l.c. 1894), specimens of *P. apacheca* had formerly been referred to *P. ponderosa* and *P. engelmannii*. In 1895, he tentatively conceded that apache pine could be a synonym of *Pinus latifolia* (q.v.) of SARGENT (1889). Later, LEMMON (1900, p. 112) argued that *Pinus apacheca* 'may best be regarded as 'Variety *Apacheca* of *Pinus mayriana* SUDWORTH' (q.v.). GAUSSEN (1960, p. 75 and 130) reduced *Pinus mayriana* SUDWORTH to a variety of *Pinus apacheca* LEMMON (omitting to quote SUDWORTH as the author of the epithet '*mayriana*') and at the same time tentatively affiliated this variety (as a synonym) to *P. ponderosa* var. *mayriana* [(SUDWORTH)] SARGENT by stating: 'The synonymy is very confused and the entire subject of *P. ponderosa* and related species ought to be taken up by a systematic botanist. Foresters investigating the subject give too little weight to morphological and anatomical details' (translated by the present author).

Pinus apacheca LEMMON ought to be compared, especially to *Pinus engelmannii* CARRIÈRE and to *Pinus latifolia* SARGENT.

'arizonica'

Pinus arizonica ENGELM., in: Rep. U.S. geogr. surv., Wheeler, vol. 6: 260 '1878' (1879).

Pinus ponderosa ssp. *arizonica* (ENGELM.) E.MURRAY, Kalmia 12: 23 (1982).

Pinus ponderosa var. *arizonica* (ENGELM.) SHAW, Pines Mexico, Publ. Arnold Arbor. 1: 24 (1909).

H o l o t y p e : 'United States, Arizona, Santa Rita Mts. at 7000 ft. (c. 2100 m)', J.T. Rothrock No. 652, collected 1874, [MO 3377654].

Pinus arizonica is mainly a Mexican pine; its geographic range barely extends into the United States in extreme southwestern New Mexico und southeastern Arizona. Viewed from Mexico, modern workers consistently concede it specific rank. Indeed, *Pinus arizonica* ENGELMANN could well be more closely related to *Pinus durangensis* MARTINEZ, than it is to *Pinus ponderosa*. Conforming to current usage, it would in such a case have to be transferred to the 'montezuma complex'. In the United States Arizona pine is usually treated as a variety (or ssp.) of *Pinus ponderosa* DOUGLAS ex C. LAWSON.

Two infraspecific taxa (var. *stormiae* MARTINEZ [q.v.] and fa. *quinquefoliata* MARTINEZ [q.v.]) have been affiliated to Arizona pine.

Pinus arizonica deserves to be subject of an independent investigation and taxonomic revision.

'baja-californica'

Pinus jeffreyi var. *baja-californica* SILBA, Phytologia 68: 52 (1990).

H o l o t y p e : 'Mexico. Baja California Norte: Yellow Pine belt between Ojos Negros and Neji Rancho'. Wiggins & Gillespie 4123 [NY]. P a r a t y p e : Wiggins & Demaree 4920 [NY].

This taxon and *Pinus peninsularis* LEMMON (q.v.) could be synonymous and ought to be compared to *Pinus jeffreyi* s.str.

'beardsleyi'

Pinus beardsleyi A.MURRAY, Description of New Coniferous Trees from California. Edinburgh New Philos. J. (n.s.) 1: 286, plate 6 (1855).

T y p e : United States, California, Scott Mountain (easternmost peak of Scott Mountain range in northeasternmost Trinity County, just outside the southeastern boundaries of Klamath National Forest), a few km south-west of Mt. Shasta, California (see also comment sub '*craigana*'), at an altitude of about 1500 to 1800 m NN (as stated in the protologue). Collectors William Murray and A.F. Beardsley.

L e c t o t y p e (designated here): Needles, ovuliferous cone and other details figured in A. Murray (l.c. 1855), plate 6. Although a specimen obviously existed (evidenced by the figures in plate 6), a holotype is not cited in the protologue. A. Murray's collections are at [E]. But searches for this specimen have been unsuccessful to date. An epitype - specimen ought to be collected in the type locality stated above.

A specimen of '*Pinus Bairdsleyi*' in MO (s.n., a sterile twig originating from 'Hort. bot. Kew, Sept. 13 1869' (when Engelmann toured through Europe and visited its main herbaria, WHITE 1902), although certainly not genuine type material, could nevertheless be 'authentic' material originating from a tree at Kew and grown from seed collected and sent to Edinburgh by William Murray and A.F. Beardsley (see also sub '*craigana*'). But such a tree is neither documented to have existed, nor could such a tree, or a specimen from it, be unearthed at [K] in 1992.

KELLOGG (1882, p. 44) mentions a 'Beardsley variation' (of *Pinus ponderosa*); however, it is not clear whether this short reference already documents an actual intention of the author to alter the taxonomic rank of *Pinus beardleyi* A. MURRAY.

Pinus beardleyi, *P. craigana* (q.v.) and *P. ponderosa* var. *ponderosa* seem to have much in common.

'benthamiana'

Pinus benthamiana Hartw., J. Hort. Soc. London 2: 189 (1847). Gordon G., J. Hort. Soc. London 4: 212 - 214 (1849). - c. ic.

Pinus ponderosa var. *benthamiana* (HARTW.) VASEY, (Ann.) Rep. U.S. Commiss. Agric. 1875: 178 (1876).

L e c t o t y p e (LAURIA 1996): 'United States, California, Santa Cruz mountain area', C.T. Hartweg s.n. [W]; Isolectotype also at [W].

For an account of the botanical history of *Pinus benthamiana* HARTWEG and for more details on type material, see LAURIA (1996).

'blancoi'

Pinus engelmannii var. *blancoi* MARTINEZ, Los Pinos Mexicanos 288 (1948).

Pinus macrophylla (ENGELM., nec LINDL. nor TORR.) var. *blancoi* MARTINEZ, Anales Inst. Biol. Univ. Nac. Mexico 15: 345 (1945).

H o l o t y p e : 'Mexico, Durango, Santiago Bayacora, at from 2500 to 2800 m NN' (protologue) [MEXU ?]. The author has not yet seen Maximo Martinez' types.

'brachyptera'

Pinus brachyptera ENGELM. in WISL., Mem. tour N. Mexico 89 (1848).

'*Pinus brachyptera* WISL.' in: E.-A. CARRIÈRE, Rev. Hort. (ser. 4) 3: 227 (1854).

Pinus ponderosa var. *brachyptera* (ENGELM.) LEMMON, Bienn. Rep. Calif. State Board Forest. 2: 73, 98 (1888).

L e c t o t y p e (designated here): 'United States, New Mexico, where the mountains begin, about Rock Creek to Santa Fe', 5 July 1846, A. Wislizenus 534' [MO 1817026]; Isolectotype [MO 1817027]. A lectotype is here designated on formal grounds. The sheet [MO 1817026] is selected for its richer material.

Following his examination of the forest trees of California while attached to Williamson's and Abbott's Pacific Railroad Survey, NEWBERRY (1858) reduced *Pinus brachyptera* to a synonym of *Pinus ponderosa*. Like most other contemporary professional botanists in the scientific centers of the time, George Engelmann was also greatly influenced by Newberry's interpretation of what he had seen (LAURIA 1996). Engelmann never used the name *P. brachyptera* again, neither for collections clearly originating from the same general area, nor for specimens obviously matching it in botanical characteristics (ENGELMANN 1863; 1875; 1879a; PARRY & ENGELMANN 1862). Following his own visitation of the forests of California, Engelmann later nonetheless considered *Pinus ponderosa* 'of the Rocky Mountain floras' to be distinct from that of the Pacific Slope. However, instead of returning to his former epithet '*brachyptera*', he surprisingly coined a new name: *Pinus ponderosa* var. *scopulorum* (q.v., ENGELMANN 1879b).

'cortex-nigra' (see '*nigricans*')

'coulteri'

Pinus coulteri D. DON, Trans. Linn. Soc. London 17: 440 (1836).

Pinus ponderosa ssp. *coulteri* (D. DON) E. MURRAY, Kalmia 12: 23 (1982).

Reasons warranting this change of rank and affiliation of *Pinus coulteri* to *P. ponderosa* are not stated.

'craigana' (often written '*craigiana*')

Pinus craigana A. MURRAY, Description of New Coniferous Trees from California, Edinburgh New Philos. J. (n.s.) 1: 288, plate 7 (1855).

Type: United States, California, Scott Mountain (easternmost peak of Scott Mountain range in northeasternmost Trinity County, just outside the southeastern boundaries of Klamath National Forest), a few km south-west of Mt. Shasta, California (see below), at an altitude of about 1200 to 1500 m NN (protologue, see also sub *Pinus beardsleyi* A. MURRAY). Collectors William Murray and A.F. Beardsley (see below). Named in honour of W. Gibson-Craig, a prominent fellow of the 'Oregon Botanical Association'.

Lectotype (designated here): Needles, ovuliferous cone and other details figured in A. MURRAY (l.c. 1855), plate 7.

Although a specimen obviously existed (as evidenced by the figures in plate 7), a holotype is not cited in the protologue. A. and W. Murray's collections are at [E]. But searches for this specimen have all been unsuccessful to date. An epitype - specimen ought to be collected in the type locality stated above.

Although irrelevant for the purpose of typifying the present *Pinus craigana* A. MURRAY (1855), two sheets of a *P. craigana* nevertheless exist at [E]. These specimens have greatly confused the present writer, as they obviously have also confused George Engelmann in 1869. To avoid similar misunderstandings in the future,

an account of the different *Pinus craigana*'s (and also of *Pinus beadsleyi*), as it emerged after a detailed study of all available (in part unpublished) sources of information, is presented:

In 1849, a number of Scottish conifer enthusiasts formed the 'Oregon Botanical Association' with the objective of sending an explorer to northwestern North America, the general area formerly surveyed by David Douglas, to discover and collect specimens and seeds of new or otherwise desirous conifers. At the suggestion of J.H. Balfour (chairman) and Andrew Murray (secretary), the Scot John Jeffrey was employed as collector. Apart from discovering e.g. *Pinus jeffreyi* (in Shasta Valley, Calif. in 1852), the zealous J. Jeffrey also collected other species of conifers (see list in A. MURRAY 1853). These collections were mainly determined by J.H. Balfour, although other experts, like John Lindley, or George Gordon, were sometimes consulted. John Jeffrey unexpectedly disappeared early in 1854, probably perishing in the 'Colorado Desert', while on the way to Fort Yuma, Arizona (COVILLE, 1897; JOHNSTONE 1939). Pending a decision by the committee to nominate another collector, secretary Andrew Murray asked his brother William Murray, then a resident of San Francisco, to meantime continue Jeffrey's survey of northern California. In the fall of 1854, William Murray set out in company of A.F. Beardsley, a local professional collector. Their specimens were determined and published by Andrew Murray. The itinerary of W. Murray and A.F. Beardsley is not known. However, the scattered references to places of collection of their discoveries indirectly indicate that these explorers may have concentrated most of their collecting activities to Scott Mountain, a few km south-west of Mount Shasta:

Along with *Pinus beadsleyi* and *P. craigana*, A. MURRAY (1855, p. 289) also described *Abies hookeriana* (now *Tsuga mertensiana*). Concerning its type locality he stated: 'collected high up the California mountains, about lat. 41° N'; and in the Latin protologue: 'in iisdem montibus quam precedens' (which is *Pinus craigana*). In 1865, A. MURRAY (in RAVENSCROFT 1884, p. 155) finally specified 'Scotts Mountain, one of the high California mountains, about lat. 41°20' N., long. 122°37' W., where the ground was already covered with snow, on the 16th of October' as the place of collection of the *Tsuga* (see also HENRY 1914). Scott Mountain is thus also the type locality for *Pinus beadsleyi* and *Pinus craigana*. On page 121, A. MURRAY (in RAVENSCROFT 1884) also stated: 'W. Murray and Beardsley traversed Northern California in various directions in their expeditions, and they never met with the Douglas spruce until they reached Scotts Mountain, a little to the south-west of Mount Shasta'.

One main purpose of the writer's visit to Royal Botanic Garden, Edinburgh, in June 1992, was to search for the types of several taxa of *Pinus* appertaining to the Ponderosa-complex: The type cone of *Pinus jeffreyi* BALF. (collected by John Jeffrey), and the type specimens of *Pinus beadsleyi* A(ndrew) MURRAY, and *Pinus craigana*

A. MURRAY, both collected by Wm. Murray and A.F. Beardsley. Very agreeably surprised, at first, to find (two sheets of) the long searched for *Pinus craigana* (one consisting of two similar, sterile twigs, the other of two different sterile twigs, including one determined as a '*Pinus ponderosa* var. *jeffreyi*' of unspecified source), the present writer did not pay any attention to the fact that these sheets had been filed under *Pinus attenuata* LEMMON; nor did he pay enough attention to the fact that these specimens were labelled as follows: 'No 705, *Pinus craigana* [name indistinctly crossed out diagonally], Salmon River Mountains, Lat. 41°, Oct. 1. 1852, Jeffrey' and the other '*Pinus* sp. No. 705, Oct. 1st 1852, Salmon River Mountains, Lat 41°'. At that time (in 1992) neither the locality (Salmon River Mountains), nor the collection No. (705) had any specific meaning and the collector's name stated on the sheet (Jeffrey) was thought to be a misunderstanding. Since the taxonomic status and potential distinguishing characteristics of *Pinus craigana* A. MURRAY of 1855 yet remain to be investigated, the writer was also not preoccupied by the rather slender leaves of this specimen.

However, while studying the minutes and papers of the 'Oregon Botanical Association' also preserved at Edinburgh (the mission of John Jeffrey to northwestern North America) the writer happened to come across some letters of J.H. Balfour and W. Gibson-Craig sent to Andrew Murray (typewritten transcriptions in Box 2, Folder 3, p. 4, 5, and 26 of the Mss), which indicated that a pine collected by John Jeffrey (No 705) in 1852, and which A. Murray intended to name '*Pinus craigana*', was identified right in time shortly before publication, to be identical with *Pinus tuberculata* (now *Pinus attenuata* LEMMON), a pine already well known in 1853. This '*Pinus craigana*' was therefore never published (see also the 'Circulars' of the Committee dated 16th April 1853 [John Jeffrey's field notes] and September 1853 [MURRAY 1853], in which John Jeffrey's discoveries, named and described by J.H. Balfour, were made known to the fellows of the Society [Folder 1 in Box 2 of the Mss]).

At the turn of 1854 and 1855, when W. Murray and A.F. Beardsley again sent specimens of conifers presumed to be new, these were named and published by A. Murray (l.c. 1855), including a *Pinus beardsleyi* (in honour of Mr. A.F. Beardsley, companion of William Murray during the expedition) and a *Pinus craigana* (in honour of the same William Gibson-Craig of Edinburgh for whom Andrew Murray only had intended to name a quite different pine already in 1853).

Therefore, although no material of the duly published *Pinus craigana* A. MURRAY of 1855 (collected by William Murray and A.F. Beardsley) appears to have survived, two specimens of a fictive '*Pinus craigana*' inedita of 1853 (specimens of *Pinus attenuata* LEMMON, collected by John Jeffrey) now well exist at [E].

George Engelmann was in his time an authority on conifers and on the anatomy of leaves of the various species of pines. When he visited Edinburgh and its herbarium on August 30, 1869 (Engelmann toured through Europe in 1868 and 1869, see

WHITE 1902), he obviously received also at [E], as had become customary on similar occasions in other herbaria, some material (single fascicles of needles) of *Pinus craigana*. Two specimens of *Pinus craigana* exist at MO today. One (MO 3574203) only consists of two fascicles of needles (in threes) and a rather long annotation by Engelmann, of which the following parts are of interest: '*Pinus craigana* Murray, Salmon River Mountains,, No 705,, Jeffrey?,, is it *P. ponderosa*? yes!,, another sheet has two specimens with same label, one of them is same as last, but the other is a much stouter plant with longer sheaths, longer leaves and larger, ovate, more squamose bud'. The following sentence was obviously added at a later date: '*P. Fremontii* Murray in Hb. Edinb. is about the same as the slenderleaved *Craigana*'.

These annotations clearly indicate that Engelmann had also not seen the type specimen of *Pinus craigana* A. MURRAY, but only the two sheets of '*Pinus craigana*' inedita (three sterile twigs of *Pinus attenuata* and one sterile twig of *Pinus jeffreyi* as detailed above), and was also necessarily misled into wrong determinations by the confusing circumstances surrounding these specimens. The meaning of the name '*P. Fremontii*' is not clear (the name does not reappear in the Mss of the 'Oregon Botanical Association'), but written down from recollection, Engelmann could perhaps have mistaken it for *P. beardsleyi*?

The other specimen (MO 3574205) is a sterile twig with thicker needles of the *ponderosa*-type, annotated 'Hort. bot. Edinburgh, Aug. 30, 1869'. Another annotation on the same sheet ('compared with the type') indicates that this specimen was compared to the '*P. craigana*' ined. mentioned above. However, since material of *Pinus craigana* A. MURRAY from other sources (other than the specimens and seeds sent by William Murray and A.F. Beardsley in 1854 or 1855) is unlikely to have existed in Scotland in 1869, this specimen could nonetheless be 'authentic' material, originating from a tree at Edinburgh and grown from seed collected by Murray and Beardsley, though such a tree is neither documented to ever have existed, nor was such a tree (or a specimen from it) present at [E] in 1992. Therefore, the designation of the figures in plates 6 (for *Pinus beardsleyi*) and 7 (for *P. craigana* A. MURRAY 1855) seems to be the correct course of action to lectotypify these taxa.

Pinus beardsleyi (q.v.), *P. craigana* and *P. ponderosa* var. *ponderosa* seem to have much in common.

'*crispata*'

Pinus ponderosa [fa.] *crispata* SCHWER., Mitt. Deutsch. Dendrol. Ges. 1919: 325 (1919); also l.c. 1920: 43 (1920).

Type: Canada, British Columbia, Kamloops; a single plant among many normal seedlings, raised from seed imported from that area. All searches for a specimen from this tree have been unsuccessful.

A cultivar with sickle-shaped needles, rare in cultivation (den OUDEN & BOOM 1965). A living tree is nowhere documented to exist.

'deflexa'

Pinus deflexa TORR., in: Emory, Rep. U.S. Mex. Bound. Surv. 209 (1859).

Pinus jeffreyi var. *deflexa* (TORR.) LEMMON, Bienn. Rep. Calif. State Board Forest. 2: 74, 100 (1888). Basionym cited, although not a reference to the original publication.

Pinus ponderosa 'fa.' *deflexa* ROB., Fl. & Sylva 3: 104 (1905). Basionym not cited.

H o l o t y p e : 'United States, California, Mountains east of San Diego'. C.C. Parry s.n., June 1850 [NY].

A sheet and a separate cone. Unlike the (ripe) cone (reminiscent of a regular cone of *Pinus jeffreyi*) which is figured on plate 56 in TORREY (l.c. 1859), the type-cone clearly is but an imperfect, immature jeffrey pine cone (collected in June!).

'durangensis'

LOOCK (1950, p. 90, 205) and perhaps also other recent workers include *Pinus durangensis* MARTINEZ and *Pinus durangensis* fa. *quinquefoliata* MARTINEZ, both generally considered to appertain to the montezuma-complex, into their 'group ponderosa'.

'engelmannii' (CARRIÈRE, not TORREY)

Pinus engelmannii CARRIÈRE, Rev. Hort. (ser. 4) 3: 227 (1854).

Pinus macrophylla ENGELM. (not LINDL., nec TORR.) in: WISL., Mem. tour N. Mexico, 103 (1848).

Pinus ponderosa var. *macrophylla* (ENGELM.) SHAW, Pines Mexico, Publ. Arnold Arbor. 1: 24 (1909).

Pinus ponderosa fa. *macrophylla* '(SHAW)' den OUDEN & BOOM, Man. Cult. Conif. 340 (1965). - Basionym cited, although with some formal errors.

L e c t o t y p e (E.L. Little 1957, not published): 'Mexico, Chihuahua, common about Cosiquiriachi [now Cusiuhiriachic], only on high mountains at 7000 ft.' [c. 2100 m], A. Wislizenus 233, Octob. 1846 [sheet MO 3377671 and separate cone MO 3534934]; Isolectotypes: [MO 3377672 and 3377673].

Pinus macrophylla ENGELMANN is a homonym postdating *P. macrophylla* LINDLEY (of 1839). This was noted by CARRIÈRE (1854), who changed the name to *Pinus engelmannii*. When M. MARTINEZ coined his taxon '*blancoi*' in 1944, he at first described it as a variety of *Pinus macrophylla* ENGELM. Upon realizing that this name is a later homonym, he transferred his taxon to the new combination *P. engelmannii* (CARRIÈRE) var. *blancoi* (MARTINEZ) MARTINEZ (1948, q.v.).

Pinus engelmannii CARRIÈRE deserves a study and taxonomic revision of its own.

'engelmannii' (TORREY, not CARRIÈRE)

Pinus engelmannii TORR. in: A.W. WHIPPLE, Pacif. Railr. Rep. 4 (4): 141 (1857).

H o l o t y p e : 'United States, California, Sonora - hill sides, May 1854'. Collector J.M. Bigelow s.n., det. '*Pinus brachyptera* ENGELM.' [NY s.n., sheet and separate cone].

After Whipple's exploring party had dispersed near Los Angeles early in 1854, J.M. Bigelow continued to collect plants in California (JEPSON 1962), including the present specimen. In the printed botanical report John Torrey (doubtfully) 'changed the specific name' from *Pinus brachyptera* to '*Pinus engelmannii*', but (unintentionally ?) omitted at the same time to quote the author (Carrière). This omission resulted in the accidental 'formation' of a later homonym, which was subsequently perpetuated by other workers, who listed it as another of the synonyms of *P. ponderosa*. This 'synonym' is at least indubitably typified with Bigelow's specimen named above.

'hondurensis'

LOOCK (1950, p. 90, 210) includes *Pinus hondurensis* LOOCK into his 'group *ponderosa*'.

'jeffreyi' (including 'jeffreyana')

Pinus jeffreyi BALF. in: A. MURRAY, Bot. Exped. Oregon, Rpt. No 8: 2, and unnumbered plate (1853).

'*Pinus jeffreyana*' VAN HOUTTE, Catalogue de Plantes et de graines, Gand, Belgium, No. 53: 51 (automne et hiver de 1854).

Pinus ponderosa ssp. *jeffreyi* (BALF.) E. MURRAY, Kalmia 12: 23 (1982).

Pinus ponderosa var. *jeffreyi* (BALF.) VASEY, (Ann.) Rep. U.S. Commiss. Agric. 1875: 179 (1876).

Pinus ponderosa var. *jeffreyi* (A.MURRAY) ENGELM. in: S. Watson, Bot. Calif. 2: 126 '1880' (1879). - comb. superfl.

H o l o t y p e : 'United States, California, Shasta valley (Chastey Valley, Lat. 41°30', Oct. 24th 1852)', (John) Jeffrey No 731 [E]. I s o t y p e [CGE]: A sterile specimen, hand and wording of label identical with that of holotype. Obviously originating from the type collection.

When seen in Dec. 1987, the holotype only consisted of one bud, three fascicles and several fragments of needles, and three crushed seeds. 'A' (?) large cone mentioned on the sheet was missing and its whereabouts was still unknown in 1992. However, the quite excellent figure of the cone shown in the unnumbered plate contained in MURRAY (1853) leaves no doubt as to the identity of the species.

Like *Pinus ponderosa*, *Pinus jeffreyi* has also never been revised. One detail that still is confused is legitimate authorship, and in particular the correct way to quote it. In the past the authorship has at various times been quoted as follows:

P.j. OREGON COMMITTEE (MURRAY 1853, in use until 1943)

BALFOUR (MURRAY 1864 [in RAVENSCROFT 1884], currently in use)

A. MURRAY (PARLATORE 1868, in use until quite recently)

ENGELMANN (e.g. BOOTH 1880, used until 1885)

GREVILLE & BALFOUR (HEMSLEY 1909, currently in use)

GREVILLE (e.g. BEAN 1921, used until about 1932)

VASEY (e.g. FITZPATRICK 1929, until 1932).

As secretary of the 'Oregon Botanical Association' Andrew MURRAY also edited the undated Report No 8 (issued in September 1853; see HENRY 1914). The report is signed 'ANDw. MURRAY, Secy.'. In the introduction he stated the following: 'The Committee now beg to send a list of the names of the different plants of which the seeds were lately distributed, as named by Sir William Hooker, Dr. Lindley, and Professor Balfour; also figures and descriptions by Dr. Greville and Professor Balfour, of the cones, leaves, and seeds of the Coniferae'. Despite this the authorship for *Pinus jeffreyi* and several other new conifers (as appendend to binomials in the enumeration of species) is quoted as 'Oreg. Com.'.

This 'mode adopted of making public the names of .. new .. plants .., namely, the registering provisional names with 'Oregon Committee' as authority' was soon criticized (HOOKER 1853), but does not seem to have been accidental. In other papers from his hand, MURRAY (1860) at first continued to quote the 'Oreg. Com.'. It was only later, that he (MURRAY [1864] in RAVENSCROFT 1884) began to name 'BALFOUR' as the author of *Pinus jeffreyi*. VASEY (l.c. 1876) reduced *Pinus jeffreyi* to a variety of *P. ponderosa*, as did ENGELMANN (l.c. 1879).

Apart from the inconsistent and confusing mode of quoting correct authorship, the pamphlet entitled 'Botanical Expedition to Oregon' is also rare (HENRY 1914; LITTLE 1944). As such it was not always accessible to all interested in the subject. These circumstances may account for the confusing use in the past, of a variety of most diverse names in quoting legitimate authorship of *Pinus jeffreyi*, as it may also explain the curious (accidental?) modification of the specific name by VAN HOUTTE (*Pinus jeffreyana*, a name mainly propagated in horticultural circles). LITTLE (1944, 1953) at last introduced some orderliness into the subject, by adopting a quotation of authorship (GREV. & BALF.) corresponding to the wording in A. MURRAY's Report No 8 (1853): '.. figures and descriptions by Dr. Greville and Professor Balfour, of the cones, leaves, and seeds of the Coniferae'.

However, Little's suggestion (1944) proves to have been offhanded, as it ignores the evidence presented by HENRY (1914) for the fact that 'the figures ... were drawn by R.K. Greville', but that 'the descriptions were written by Prof. J.H. Balfour'. Henry therefore concluded that 'the name of the latter must be attached to the new species

described' in A. MURRAY's Report No. 8 (1853). Such a practice well also conforms to the ICBN (GREUTER & al. 1994) and should be universally adopted.

Var. *ambigua* LEMMON (q.v.), var. *baja-californica* SILBA (q.v.), var. *cortex-nigra* LEMMON (q.v.), var. *deflexa* LEMMON (q.v.), var. *montana* LEMMON (q.v.), var. *nigricans* LEMMON (q.v.) and var. *peninsularis* LEMMON (q.v.) are infraspecific taxa that, at one time or another, have all been affiliated to *Pinus jeffreyi*.

Pinus jeffreyi also deserves an independent study and taxonomic revision of its own.

'koolhaas'

Pinus ponderosa var. *scopulorum* fa. *koolhaas* J.L.Mol, Jaarb. Ned. Dendrol. Ver. 1952-1953: 74 (1953).

T y p e : Not stated. Inquiries to locate either a living tree, or material from the original tree, have all been unsuccessful.

A cultivar with short leaves (11 cm); a single plant discovered in a Dutch nursery in 1939 (source of seed not stated), compact and dense in outline, with nodding leader; upper branches drooping, lowest ones spreading (den OUDEN & BOOM 1965). A drawing of the plant to demonstrate these features is appended to the description in MOL (l.c. 1953).

'latifolia' (SARGENT, not MAYR ex SARGENT)

Pinus latifolia SARG., Gard. & Forest 2: 496, 498 (1889).

'*Pinus latifolia* MAYR (ex SARG. as to publication)', Beissn., Handb. Nadelholzk. 259 (1891).

Pinus mayriana SUDW., U.S.D.A. Div. Forest. Bull. 14: 21 (1897).

Pinus apachea var. *mayriana* '(SARGENT)' in GAUSSEN, Trav. Lab. Forest. Toulouse, t. 2, sect. 1, vol. 1, fasc. 6, ch. 11: 75, 130 (1960). Incorrect author of basionym.

Pinus ponderosa var. *mayriana* (SUDW.) SARG., Silva, vol. 11: 81 (1898).

Pinus ponderosa fa. *mayriana* '(SARG.)' den OUDEN & BOOM, Man. Cultiv. Conif. 340 (1965). Basionym cited, although with formal errors.

T y p e : 'United States, Arizona, southern slopes of the Santa Rita Mountains' (SARGENT l.c. 1889), at 2000 m NN, on sunny, gravelly openings (MAYR 1890; 1906). Type material not yet located. Absent a type, this taxon could be lectotypified with the figure given by SARGENT (l.c., p. 498).

Heinrich Mayr, while surveying the forests of North America on behalf of the Government of Bavaria, Germany, discovered in 1887, at the site indicated above, a pine very different in botanical characteristics from any other pine (specimens) at that time available for comparison, either in [NY], or in [K] (MAYR 1890, p. 238). Unable to identify it, he sent a specimen of it to C.S. Sargent, who (obviously with the consent of Mayr) described it as a new species (*Pinus latifolia*). Sargent correctly credited Mayr with the discovery. BEISSNER (l.c. 1891), on the other hand felt the

need to correct Sargent, crediting Mayr with the authorship: MAYR (1890), in fact, gives a full description of his own of the new pine, although neither mentioning Sargent's authorship, nor the new name coined for it. In 1906 (p. 367) MAYR himself finally clarified the subject by stating: 'Die Zusammenstellung *Pinus latifolia* H. MAYR ist irrig' (The combination *Pinus latifolia* H. MAYR is erroneous). In 1909, BEISSNER fully accepts SARGENT as the legitimate author of *Pinus latifolia*. All references to H. Mayr as author thus only originate from misinformation at the turn of the century.

Pinus latifolia SARG. was presumed by SUDWORTH (1897, p. 9; see also LITTLE 1944) to be illegitimate under the recently adopted American 'Rochester Code' of botanical nomenclature (FAIRCHILD 1892) and he replaced its name with *Pinus mayriana* (named after Heinrich Mayr). In agreement with the current ICBN (GREUTER & al. 1994) *Pinus mayriana* SUDW. must now be regarded as a mere synonym of *Pinus latifolia* SARG. (LITTLE 1944). LEMMON (1900, p. 112) reduced his *Pinus apachea* (q.v.) to a variety of *P. mayriana*. *Pinus ponderosa* var. 'maxima' in MASTERS (1904, p. 657) is obviously only a misspelling of *P. ponderosa* var. *mayriana*.

Pinus latifolia SARGENT continued to be an accepted species until well into the 1960ies. SARGENT (1891-1902, vol. 11, 1898, p. 81) and LITTLE (1944) give a notion of the confusion surrounding this taxon and its chequered, time and again changing interrelationship with *P. apachea* LEMMON (q.v.), *P. macrophylla* ENGELM., and *P. mayriana* SUDW., all of which are today considered (e.g. LITTLE 1953) to be synonyms of *P. engelmannii* CARRIÈRE (q.v.). MASTER's motives (1892, p. 232) for considering *Pinus latisquama* ENGELM. (now *P. pinceana* GORDON) to be a synonym of *P. latifolia* SARG. do not seem to be resolvable today.

'macrophylla' (ENGELM., not LINDL., nec TORR.; see 'engelmannii')

'macrophylla' (TORR., not LINDL., nec ENGELM.)

Pinus macrophylla 'ENGELM.' in: TORR., Sitgreaves' Rept. Exped. Zuni Colorado Riv. 173 (1853).

Type: 'United States, New Mexico, Arizona, High up in the Zuni Mountains (San Francisco Mountains ?)'. Collector S.W. Woodhouse.

The description by Torrey was obviously based on a specimen. However, all searches to unearth it have been unsuccessful to date.

After an ascent of four days up the San Francisco Mountains, Woodhouse, botanist of the expedition, noted two species of pine, which he determined as *Pinus edulis* and *P. brachyptera*. There is nowhere mention of a *Pinus macrophylla* in his report. Torrey on the other hand doubtfully determined the corresponding specimen in the collection as '*Pinus macrophylla* ENGELM. ?', although he also stressed at the same time the substantial differences in botanical characteristics his specimen exhibited

as compared to Engelmann's taxon. Torrey's (mis)use of the binomial *Pinus macrophylla* (of ENGELM.), was later perpetuated by other workers who 'elevated' it (as *Pinus macrophylla* TORR.) to another synonym of *Pinus ponderosa* s.l. (e.g. SARGENT 1884; SUDWORTH 1897).

'malletii' (and mallettii)

Pinus malletii MOTTET, Conifères & Taxacées: 186 (1902); Rev. Hort. n.s. 13: 263 - 266 (1913).

Pinus ponderosa [var.] *malletii* (MOTTET) BEISSN., Mitt. Deutsch. Dendrol. Ges. 1907: 105 (1907).
- Basionym not cited, but obviously referring to the same single tree growing near Paris.

Pinus ponderosa var. *mallettii* (CROUX), GAUSSEN, Trav. Lab. Forest. Toulouse t. 2, vol. 1, chap. 11: 128, 281 (1960). - Superfluous and incorrect author.

Pinus malletii BEISSN., Mitt. Deutsch. Dendrol. Ges. 1900: 113 (1900). - Nomen nudum, referring to the same tree described in Mottet (l.c.).

Type: A cultivar grown on the estate of Baronet Mallet, near Paris, France, from cuttings rooted by M.G. Croux, horticulturist, and originating from a tree of unknown seed source that succumbed to the severe winter of 1879/1880.

Type material does not appear to exist; so far, all searches for it have been unsuccessful. A figure of the tree is appended to MOTTET (l.c. 1913).

Pinus malletii has been characterized as a particularly luxuriant form of *Pinus ponderosa* (BEISSNER l.c. 1900; l.c. 1907), or having affinity with *Pinus benthamiana* (Croux in MOTTET l.c. 1913).

'mayriana' (see 'latifolia')

'montana' (see 'ambigua')

'nana'

Pinus ponderosa [var.] *scopulorum* [fa.] *nana* BEISSN., Mitt. Deutsch. Dendrol. Ges. 1912: 365 (1912).

Type: 'United States, Colorado, Jefferson County, at the mouth of Coalcreek'. Searches to unearth either a type specimen, or other 'authentic' material have all remained unsuccessful.

At the site named above a single, globose, dwarf tree (photograph appended to the description) was found which had grown only 60 to 75 cm in about 12 years of observation and, in 1912, had attained a total height of 2.25 m. Seeds from this tree are reported to have been sent to the author in Germany. However, apart from this single publication, the 'fa. *nana*' is never mentioned again in the literature. It is presumed here, that the plantlets raised from these seeds grew to normal trees, atypical of 'fa. *nana*'.

'nigricans'

Pinus ponderosa var. *nigricans* (LEMMON) LEMMON, Revision of broken-cone pines. Calif. State Board Forest. Bull. 7: 8 (1889). - The basionym is not explicitly cited, but the intention of the author is made evident in the text.

Pinus jeffreyi var. *nigricans* LEMMON, Bienn. Rep. Calif. State Board Forest. 2: 74, 100, 101 (1888).

Type: 'United States, California, In the Sierra at low altitudes, often in wet localities' (LEMMON 1888, p. 74); 'near Beckworth', 'near Sierra Valley', 'near Sardine Valley', and 'near Sisson' (all California, LEMMON 1888, p. 101).

As with several other types of Lemmon, searches to unearth 'authentic' material of this taxon have also proven unsuccessful. A neotype ought to be collected in the areas indicated.

SUDWORTH (1897, p. 21) lists a '*Pinus jeffreyi* var. *cortex-nigra* LEMMON', Pines Pac. Slope, 7 (1888) as one of several synonyms of '*Pinus jeffreyi* OREGON COMMITTEE' (an old form of quoting legitimate authorship of jeffrey pine, q.v.). The writer was unable to unearth a copy corresponding to Sudworth's citation; it seems nonetheless clear that LEMMON's obscure 'var. *cortex-nigra*' corresponds to *Pinus jeffreyi* var. *nigricans* LEMMON of 1888, and to the altered combination *Pinus ponderosa* var. *nigricans* (LEMMON) LEMMON of 1889 which, in turn, is likely to be identical with *Pinus benthamiana* HARTWEG (see comments in LAURIA 1996).

'nootkatensis'

Pinus nootkatensis G.MANETTI, Cat. Pl. Hort. Modic., Suppl. primum, 28 (1844). - nomen nudum.

'*Pinus nootkatensis* [G.] MANETTI' ex GORDON, Pinetum (Supplement), 67 (1862). - [in synonymy].

Although not indicating his motive for concluding this, GORDON (l.c. 1862) cites *Pinus nootkatensis* MANETTI (without reference to an original publication, see also entry in Index Kewensis, JACKSON 1893 ff) as a synonym of *Pinus ponderosa* DOUGLAS. Closer searches finally brought to light that *Pinus nootkatensis* is only a nomen nudum. A publication validating this name at a later date has not been found.

'parryana'

Pinus parryana GORDON, Pinetum 202 (1858).

Pinus ponderosa var. *parryana* (GORDON) ROB., Fl. & Sylva 3: 104 (1905). - Basionym not explicitly cited, but obviously referring to the same taxon, as the tree at Highnam Court, the property of T. Gambier-Parry (after whom the tree has been named by Gordon) is cited.

Type: 'United States, Upper California, on the Sierra Nevada' (GORDON l.c. 1858), collected by Lobb and Bridges (GORDON 1875) at 3000 to 3300 m NN (SÉNÉCLAUZE 1867. The altitude should probably read 3000 to 3300 feet, which corresponds to an actual altitude of ca. 900 to 1000 m).

Although original material obviously existed in GORDON's (1858) time, so far all

recent searches for it have been unsuccessful. A neotype ought to be collected in areas indicated above.

Pinus parryana GORDON could correspond to *Pinus benthamiana* HARTWEG (see comments in LAURIA 1996).

'pendula' (also termed 'penduliformis')

Pinus ponderosa var. *pendula* H.W. SARG., Gard. Chron (n.s.) 10: 236, and fig. 42, p. 237 (1878).

'*Pinus ponderosa* var. *penduliformis* (H.W. SARG.) SUDW., U.S.D.A. Div. Forest. Bull. 14: 21 (1897).

Pinus ponderosa [fa.] *pendula* (H.W. SARG.) REHDER, Man. Cultiv. Trees ed. 2, 44 (1940). - The intention of the author to change the rank to 'fa.' is not made very explicit in the text, but is later retrospectively confirmed in REHDER (1949, p. 39).

Pinus ponderosa var. *scopulorum* fa. *pendula* R.A. VINES, Trees Shrubs Southwest, 19 (1960). - The basionym is not cited. Although other individuals of *ponderosa* pine with a weeping habit are not known to have existed, Vines' lapidary sentence ('A form with drooping branches is known as *P. ponderosa* var. *scopulorum* forma *pendula*') does not *a priori* confirm that H.W. Sargent's tree is meant.

T y p e : 'United States, Oregon or California' (presumed source of seed from which a single 'weeping' plant resulted, SARGENT 1888).

It is not known whether this tree, planted on 'Wodenethe' estate, Fishkill on Hudson, in 1851, still exists. The figure (H.W. SARGENT 1878; C.S. SARGENT 1888) gives a good impression of the drooping habit of its branches.

SUDWORTH (l.c., p. 9 and 21) changed the name in compliance with the recently adopted American 'Rochester Code' of botanical nomenclature (FAIRCHILD 1892).

'peninsularis'

Pinus peninsularis (LEMMON) LEMMON, Handb. West-Amer. Cone-Bearers ed. 4, 114 (1900).

Pinus jeffreyi var. *peninsularis* LEMMON, Bienn. Rep. Calif. State Board Forest 2: 74, 100 (1888).

Pinus ponderosa var. *jeffreyi* [fa.?] *peninsularis* (LEMMON) ROB., Fl. & Sylva: 103 (1905). - Basionym not cited, but obviously referring to Lemmon's taxon.

Pinus ponderosa var. *jeffreyi* fa. *peninsularis* (LEMMON) HARSHB. Phytogeographical Survey of North America, 639 (1911). Although the basionym is not cited, the author obviously refers to Lemmon's taxon and moreover explicitly states in full the ranks he adopted for the various taxa.

T y p e : 'Mexico, Baja California Norte, on highest, central range of mountains' (LEMMON 1888, p. 74); 'east of Todos Santos Bay, at 4000 ft. NN' (c. 1200 m; l.c., p. 100). Lemmon's types are supposed to be at [UC] but original material of this taxon has not been traced there. A neotype ought to be collected in the areas indicated.

Later, LEMMON (l.c. 1900) extended the range of this taxon well into the territory of the United States: 'San Raffael Mountains to San Pedro Martyr on white sandstone'.

This taxon and *P. jeffreyi* var. *baja-californica* SILBA (q.v.) could be synonymous and both ought to be compared to *P. jeffreyi* s.str.

'quinquefoliata'

Pinus durangensis fa. *quinquefoliata* (MARTINEZ) MARTINEZ, Los Pinos Mexicanos 232 (1948).

Pinus arizonica fa. *quinquefoliata* MARTINEZ, Anales Inst. Biol. Univ. Nac. Mexico 16: 284 (1945).

T y p e : 'Mexico, Chihuahua, Lusia, Bocoyna' [MEXU (see MARTINEZ l.c. 1948, p. 232)]. Types of M. Martinez not seen yet.

'resinosa' (W.J. HOOKER, nec alii auctores)

'*Pinus resinosa*' in HOOK. Fl. Bor.-Amer. vol. 2, 161 '1833-1840' (1838).

T y p e : 'N.W. America, United States, Canada, Hab. along with *P. lambertiana*'. A neotype ought to be collected from ponderosa pines native to appropriate areas.

Hooker (l.c.) misapplied the binomial *Pinus resinosa* for *Pinus ponderosa*, based on a similar misidentification by David Douglas (see previous sections in this paper). Later authors (e.g. MASTERS 1904) considered this mere misapplication of a name to be another later homonym of *Pinus resinosa* SOL. in AITON and made of it another synonym of *Pinus ponderosa*.

'resinosa' (TORREY, nec alii auctores)

Pinus resinosa 'L.' in TORR., Ann. Lyceum Nat. Hist. N.Y. 2: 249 (1828).

T y p e : United States, Colorado, Douglas or El Paso Counties, (at divide) between Denver, Colorado, and Colorado Springs (McKELVEY 1955). Searches for the corresponding specimen have all been unsuccessful. A neotype ought to be collected from a *Pinus ponderosa* growing in the appropriate area.

In this case the binomial *Pinus resinosa* has been misapplied by Edwin James (1823; 1825), again for *Pinus ponderosa*, but in areas now part of Colorado.

On the same expedition E. James also discovered *Pinus flexilis*, which he duly described in his account of the expedition, but of which he (deliberately ?) omitted to also collect a specimen (PARRY & ENGELMANN 1862). It seems thus safe to assume that James did also omit to collect specimens of the other species of *Pinus* seen on the expedition, including *Pinus ponderosa* which he had misidentified as '*P. resinosa*'. With no specimens available, John Torrey, who later published an enumeration of plants 'collected' by James in the Rocky Mountains, was unable to verify James' own determinations and obviously transcribed them literally.

Later authors, presuming that the name misused by (James and) Torrey represented another later homonym of *Pinus resinosa* SOL. in AITON 'elevated' TORREY's '*Pinus resinosa*' to a synonym of *Pinus ponderosa*. This and several other such 'artificial' synonyms are literally cluttering the literature (e.g. SARGENT 1884; SUDWORTH 1897).

'rigida'

In a few instances the binomial *Pinus rigida* has been misapplied for *Pinus ponderosa* (as seen on specimens and in published observations in the field). One such example of misapplication (which does not require any further comment on its historical background) is J.G. COOPER (1870). However, the name '*Pinus rigida*', misapplied for *Pinus ponderosa*, has never resulted in the 'formation' of another synonym of the latter.

'scopulorum'

Pinus ponderosa var. *scopulorum* ENGELM., in: S. Watson, Bot. Calif. 2: 126 '1880' (1879).

Pinus scopulorum (ENGELM.) LEMMON, Gard. & Forest 10: 183 (1897).

Pinus ponderosa ssp. *scopulorum* (ENGELM.) E.MURRAY, Kalmia 12: 23 (1982).

T y p e : 'United States, *Pinus ponderosa* of the Rocky Mountain floras' (ENGELMANN l.c.).

S y n t y p e s :

March 1847, New Mexico, Coll. A. Fendler No. 831 [MO 3574247] (listed in PARRY & ENGELMANN 1862, p. 332)

1851-1852, New Mexico, Coll. C. Wright No. 1887 [MO 3574240] (annot. in Engelmann's hand: 'In Mus. Kew Sept. 1869')

1853-1854, E-Montana, On Yellowstone R., F.V. Hayden [MO 3574214] (annot. in Engelmann's hand '[P.] *engelmanni* TORR., and listed as such in ENGELMANN 1863, see also next)

May 1855, South Dakota, Bad Lands Creek, Coll. F.V. Hayden on G.K. Warren's exped. 1855-1857 [MO 3574073], (according to MEISEL [1924-1929], the plants of this and the following expedition are also listed in ENGELMANN 1863, p. 209: *Pinus ponderosa*, Black Hills)

Aug. 1859, Wyoming, Head of Little Miss., F.V. Hayden on Capt. W.F. Reynolds expedition [MO 3574071], (see also previous specimen)

July 1856, Nebraska/Wyoming, Pole Creek of Platte, F.T. Bryan's expedition, Coll. Henry Engelmann, brother of G. Engelmann [MO 3574072], (all annotations are in Engelmann's hand)

1865, Arizona, Colls. Drs. E. Coues & E. Palmer 425 [MO 3574200] (annotated in Engelmann's hand: 'Dr. Coues, 1865')

Aug. 1867, Colorado, Huerfano, Coll. Dr. Parry [MO 3574225] (annotations, incl. date in Engelmann's hand)

1874, New Mexico, Santa Fe, Coll. J.T. Rothrock [MO 3574248] (Enumerated as *P. ponderosa* in ENGELMANN 1879a: 261)

June 1877, Utah, Mount Turnbull, Coll. E. Palmer [MO 3574245] (label including date in Engelmann's hand)

April 1879, South Utah, Coll. L.A. Siler [MO 3574180] (label including date in Engelmann's hand).

The specimens of *Pinus ponderosa* s.l. listed above, all collected in the Rocky Mountains (and farther to the east), are demonstrated to have been studied by George Engelmann before coining his var. '*scopulorum*', and must therefore be regarded as syntypes.

The following specimens today present in his collections at [MO] have most certainly also been available to Engelmann prior to 1880. However, since this cannot be

shown with the same certitude, they have been deliberately omitted from the list of syntypes:

MO 3574251; MO 3574228; MO 3574241; MO 3574242; MO 3574222; MO 3574227; and MO 3574223.

The infravarietal taxa fa. *koolhaas* MOL (q.v.), fa. *nana* BEISSN. (q.v.), and fa. *pendula* R.A.VINES (q.v.), have been affiliated to *Pinus ponderosa* var. *scopulorum* ENGELM.

'sinclairii' (or *sinclaireana*, respectively *sinclairiana*)

Pinus sinclairii HOOK. & ARN., Bot. Beechey Voy.: 392, t. 93, '1841' (1840). - Sometimes termed '*sinclaireana* or *sinclairiana*'.

'*Pinus sinclairiana* HOOK. & ARN.' in CARRIÈRE, Traité gén. conf.: 355 (1855).

Pinus ponderosa var. *sinclairiana* (HOOK. & ARN), ROB., Fl. & Sylva 3: 104 (1905). Basionym not cited, but the choice of the adaptation of the name proposed by Carrière implies that the same taxon is meant.

T y p e : 'United States, California, hills from Monterey to Carmelo and to Punta Pinos. Collector Dr. (Andrew) Sinclair'.

L e c t o t y p e (LAURIA 1996): The cone (exclusive of foliage) figured in HOOK. & ARN. (l.c.), table 93.

A n e p i t y p e - cone typical of *Pinus montezumae* from the vicinity of Tepic, Mexico, ought to be collected (and deposited, preferably at [K], the repository J.W. Hooker's types).

Pinus sinclairii is not related to *Pinus ponderosa* or other members of its complex; all contacts between the two taxa are merely historical (see account in LAURIA 1996).

'stormiae'

Pinus arizonica var. *stormiae* MARTINEZ, Anales Inst. Biol. Univ. Nac. Mexico 16: 284 (1945).

Pinus ponderosa var. *stormiae* (MARTINEZ) SILBA, Phytologia 68: 59 (1990).

H o l o t y p e : 'Mexico, Coahuila, Las Margaritas, Arteaga (Martinez 3455 [MEXU], see MARTINEZ 1948). Types of M. Martinez not yet seen.

'tortuosa'

Pinus ponderosa [var.] *tortuosa* CARRIÈRE, Traité gén. conf. ed 2, 445 (1867).

T y p e : A cultivar with very tortuous branches. (den) OUDEN & BOOM (1965) term it uncommon in cultivation, but a living tree is not documented to exist. The source of the seed is also not stated. Carrière's types are not known to have survived.

'washoensis'

Pinus washoensis MAS. & STOCKW., Madrono 8: 61 (1945).

Pinus ponderosa ssp. *washoensis* (MAS. & STOCKW.) E.MURRAY, Kalmia 12: 23 (1982).

Pinus ponderosa var. *washoensis* (MAS. & STOCKW.) W.S.TING, Univ. Calif. Publ. Geol. Sci 58: 114 (1966). Basionym not cited.

Holotype: 'United States, Nevada, Washoe County, east side of Mount Rose', at 8100 ft. (c. 2500 m) NN, Mason 12370, August 6, 1940 [UC No. 692993 (sheet 1 with female conelets and mature cone) and 692994 (sheet 2 with staminate conelets and ripe ovuliferous cone)].
Isotypes: CAS, NY (Isotypes reported in FARJON 1993).

These sheets also bear the following annotation: 'This material does not exceed the limits of variability, in any character visible, of *Pinus ponderosa* DOUGL. ex LAWS. var. *ponderosa*, North Plateau race, as found in British Columbia. T.C. Brayshaw, 5 Feb. 1986'. And indeed, there exists a growing number of notoriously unverified reports (detailed in NIEBLING & CONKLE 1990, p. 307) that *Pinus washoensis* may not be a narrow endemic, but is actually much more widespread than commonly assumed. All these reports have time and again cast doubt on the specific validity of washoe pine (see references in LAURIA 1991; and also the introductory chapters of this paper).

These doubts are moreover well supported by the results of the recent study of genetic diversity in *Pinus washoensis* (NIEBLING & CONKLE 1990). The authors found not only the expected low level of genetic distance ('0,004') between the few accepted washoe pine populations, but also an identical (!) low average value of genetic distance between washoe pine and the populations of North Plateau ponderosa pine investigated in this study. NIEBLING & CONKLE (1990) well admit that a genetic distance value of only '0,004' is considerably less than the value normally delimiting varieties, although the obvious implications of such a finding have been overlooked: These results would at least tentatively suggest that North Plateau ponderosa pine and washoe pine are only one and the same taxonomic entity.

The results of the present study (and CALLAHAM, in prep., pers. comm. 1995) clearly confirm this: *Pinus ponderosa* in its original Douglasian and Lawsonian sense (as neotypified in this study) and *Pinus washoensis* MAS. & STOCKW. are also virtually identical in physical characteristics. Washoe pine can thus now safely be rejected as another mere synonym of *Pinus ponderosa* s.str. That these facts have remained in the dark for so long a time only confirms the inadequate state of botanical exploration of *Pinus ponderosa* of at least the North Plateau region.

Acknowledgements

In its substance this paper was originally subject of a speech delivered at the conference 'The Exploration and Opening up of America as Mirrored by Natural History' held in Vienna, Austria (Museum of Natural History) in 1992.

I take this as an opportunity to thank Ing. R. Klemm and the Österreichische Gartenbaugesellschaft, Wien, for providing access many times to some rare publications only available at this library. During my stay in Great Britain in 1992 Dres. C.N. Page, M. Gardner and Colin Will, Royal Botanic Garden, Edinburgh, and the library staff of the Royal Horticultural Society, London, were very

helpful making available to me for study the manuscripts of the Oregon Botanical Association, and those of David Douglas, respectively. Mr. D.T. Reid, Edinburgh, historian and interested in the story of Scottish nurserymen kindly pointed my attention to some valuable titles relating to the former seedsmen Peter Lawson & Son at Edinburgh.

The late A. Mitchell very kindly supplied me with valuable, latest up to date information about some of the notable veteran-trees I was interested in, and about some gardens in Great Britain.

I am very much indebted to his excellency M. Al-tajir, to Mrs. C. Little and to Messrs. D. Binns, J. Hervey-Bathurst, K. Piper, R.D. Turner, A. De Vere and D. Wilkin for their kind permission to visit their respective gardens, and for their kind patience and assistance while I was having a close and extensive look at veteran-trees of *Pinus ponderosa* present there.

I gratefully acknowledge the critical comments and helpful suggestions to improve the manuscript received from the late Dr. Brian Styles, Oxford. I owe many thanks to Michael Frankis, Newcastle upon Tyne, for several valuable suggestions and for generous assistance in converting an earlier draft of this manuscript into a text readable to an English speaking public. I thank Drs. A. Farjon, R.Z. Callaham, E. Vitek and B. Wallnöfer for critically reviewing and constructively commenting on earlier and/or later versions of the manuscript. Dr. Vitek's kind guidance in solving some tricky problems of nomenclature and typification is also gratefully acknowledged.

This paper is one of the results of research kindly supported by the Austrian Science Foundation, grant P 8967-BIO.

Bibliography

ANONYMOUS (1835a): Loudon's Arboretum Britannicum, No. I. — *Gent. Mag.* n.s. 3: 296-298.

ANONYMOUS (1835b): Loudon's Arboretum Britannicum, Nos. V-VI. — *Gent. Mag.* n.s. 4: 238-240.

ANONYMOUS (1837a): Loudon's Arboretum Britannicum, Nos. XXXIX and XL. 1837. — *Gent. Mag.* n.s. 8: 59.

ANONYMOUS (1837b): Arboretum Britannicum, by J.C. Loudon. Nos. XLIV - XLV. 1837. — *Gent. Mag.* n.s. 8: 388-389.

ANONYMOUS (1838): Arboretum Britannicum, by J.C. Loudon. No. XLVII to LIV. — *Gent. Mag.* n.s. 9: 513-515.

ANONYMOUS (1855): Highnam Court, near Gloucester. The residence of T. Gambier Parry, Esq. — *Florist Fruitist Gard. Misc.* 1855: 136-139.

ANONYMOUS (1885): Bayfordbury. — *Gard. Chron.* n.s. 24: 229-230.

ANONYMOUS (1892): Highnam Court. — *Gard. Chron.* 3rd. ser., 12: 177-178.

ANONYMOUS (1909): The Bayfordbury pinetum. — *Gard. Chron.* 3rd. ser., 45: 228-230.

- ADAMS G.H. & al. (21 'participants', 1977): Some trees of Eastnor Castle. Guide produced by the Midland Tree Survey Group of the Department of Extra Mural Studies of the University of Birmingham. pp. 16.
- ANTOINE F. (1840): Coniferen. - Wien.
- BAILLIE W. & J.C. LOUDON (1828): Some account of the flower - gardens and the pinetum at Dropmore. — Gard. Mag. 3: 257-269.
- BALFOUR F.R.S. (1925): 'Botany' (pp. 1-89, reprinted from vol. 1, ch. 10) — In: J.W. BUCHAN (ed.), A history of Peeblesshire, 3 vols. - Glasgow.
- BALFOUR F.R.S. (1932): The history of conifers in Scotland and their discovery by scotsmen. — In: F.J. CHITTENDEN (ed.), Conifers in Cultivation. The report of the conifer conference held by the Royal Horticultural Society, Nov. 10-12, 1931: 177-211. - London.
- BALFOUR F.R.S. (1942): David Douglas. — J. Roy. Hort. Soc. 67: 121-128, 153- 162, figure 42.
- BALFOUR F.R.S. (1944-45): Archibald Menzies, 1754-1842, botanist, zoologist, medico, and explorer. — Proc. Linn. Soc. London 156th session 1943-1944: 170-183.
- BALFOUR GOURLAY W. (1947): Dawyck. The house and garden of the late Mr. F.R.S. Balfour. — J. Roy. Hort. Soc. 52: 5-12.
- BANDINEL B. (1843-1851): Catalogus librorum impressorum bibliothecae Bodleianae in Academia Oxoniensi, vols. 1-4. - Oxford.
- BARKER A. (1888): Eastnor Castle. — Garden (London) 33: 357-358.
- BARNHART J.H. (compiler) (1965): Biographical notes upon botanists, 3 vols. (ed. by New York Botanical Garden). - Boston, Mass.
- BEAN W.J. (1921): Trees and shrubs hardy in the British Isles, 3rd ed. - London: John Murray.
- BEISSNER L. (1909): Handbuch der Nadelholzkunde, 2nd ed. - Berlin: Paul Parey.
- BOASE F. (1908, 2nd impression 1965): Modern English biography, vol. 4 (suppl. to vol. 1). - Privately printed.
- BOOTH J. (1880): Feststellung der Anbauwürdigkeit ausländischer Waldbäume. - Berlin: J. Springer.
- CALLAHAM R.Z. (in prep.): *Pinus ponderosa*: A Taxonomic Review with Five Subspecies in the United States.
- CARRIÈRE É.-A. (1854): *Thuja gigantea* et autres conifères de la Californie et du Mexique septentrional. — Rev. Hort. 4ème ser. 3: 227.
- CHAUDHRI M.N., VEGTER I.H. & C.M. DE WAL (1972): Index Herbariorum part II(3). - Utrecht.

- CHITTENDEN F.J. (1932): Statistical returns of conifers. — In: F.J. CHITTENDEN (ed.), *Conifers in cultivation. The report of the conifer conference held by the Royal Horticultural Society*, Nov. 10-12, 1931, pp. 316-596. - London.
- CLINTON-BAKER H. (1909): *Illustrations of conifers*, 2 vols. - Privately printed.
- CONKLE M.T. & W.B. CRITCHFIELD (1988): Genetic variation and hybridization of ponderosa pine. — In: BAUMGARTNER D.M. & J.E. LOTAN (eds.), *Ponderosa pine. The species and its management*, pp. 27-43. - Spokane, Wash.
- COOPER J.G. (1870): *The Silva of Montana*. — *Amer. Naturalist* 3: 405-422.
- COVILLE V. (1897): The itinerary of John Jeffrey, an early botanical explorer of western North America. — *Proc. Biol. Soc. Wash.* 11: 57-60.
- CRISWELL E.H. (1940): *Lewis and Clark: Linguistic Pioneers*. — *Univ. Missouri Stud.* 15.
- CRITCHFIELD W.B. (1963): Hybridization of the southern pines in California. — *Southern Forest Tree Improvement Committee Publ.* 22: 40-48.
- CUSSANS J.E. (1870-1881): *History of Hertfordshire*. - London.
- DESMOND R. (1977): *Dictionary of British and Irish Botanists and Horticulturists*. - London.
- DESMOND R. (1984): *Bibliography of British gardens*. - Winchester, Hampshire, GB.
- DON G. (1831-1838): *A general history of dichlamydeous plants (A general system of gardening and botany)*, 4 vols. - London.
- DOUGLAS D. (1827): An account of a new species of *Pinus*, native to California. — *Trans. Linn. Soc. London* 15: 497-500.
- DOUGLAS D. (1914): *Journal kept by David Douglas during his travels in North America 1823-1827*. - London: Ed. Royal Horticultural Society.
- DUFFIELD J.W. (1952): Relationships and species hybridization in the genus *Pinus*. — *Z. Forstgenet. Forstpflanzenzücht. (Silvae Genet.)* 1: 93-97.
- ELLIOTT T.C. (ed.) (1912): *Journal of John Work, November and December, 1824*. — *Wash. Hist. Quart.* 3: 198-228.
- ELLIOTT T.C. (ed.) (1914a): *Journal of John Work, June-October 1825*. — *Op. cit.* 5: 83-115.
- ELLIOTT T.C. (ed.) (1914b): *Journal of John Work, Sept. 7th-Dec. 14th, 1825*. — *Op. cit.* 5: 163-191.
- ELLIOTT T.C. (ed.) (1914c): *Journal of John Work, Dec. 15th, 1825, to June 12th, 1826*, — *Op. cit.* 5: 258-287.
- ELLIOTT T.C. (ed.) (1915): *The Journal of John Work; July 5-September 15, 1826*. — *Op. cit.* 6: 26-49.
- ELWES H.J. & A. HENRY (1906-1913): *The trees of Great Britain and Ireland*, 7 vols. - Edinburgh.

- ENGELMANN G. (1863): 'Botany' (ch. 18). In: HAYDEN F.V., On the geology and natural history of the Upper Missouri. — Trans. Amer. Philos. Soc. n.s. 12: 1-218.
- ENGELMANN G. (1875): The coniferae of the Rocky Mountains. — Gard. Monthly 17: 151-153; 181-184; 214-217.
- ENGELMANN G. '1878' (1879a): 'Coniferae'. In: ROTHROCK J.T., 'Botany', Report upon United States Geographical Surveys west of the 100th Meridian 6 (G.M. Wheeler's report): 255-263. - Washington, D.C.
- ENGELMANN G. '1880' (1879b): 'Abietinae'. In: S. WATSON, Botany of California, vol. 2: 117-128. - Cambridge, Mass.
- FAIRCHILD D.G. (1892): Proceedings of the Botanical Club of the Forty-first Meeting of the A.A.A.S., Rochester, N.Y., August 18-24, 1892. — Bull. Torrey Bot. Club 19: 281-297.
- FARJON A. (1984): Pines. Drawings and descriptions of the genus *Pinus*. - Leiden, Netherlands.
- FARJON A. (comp.) (1991): Draft list of names in current use (NCU) in *Pinaceae* in the ranks of genus to varietas inclusive. - IAPT.
- FARJON A. (1993): Names in current use in the *Pinaceae* (Gymnospermae) in the ranks of genus to variety. In: GREUTER W. (ed.), Names in Current Use in the Families *Trichocomaceae*, *Cladomaceae*, *Pinaceae* and *Lemnaceae* (NCU-2). — Regnum Veg. 128: 107-146.
- FARJON A. (1995): Typification of *Pinus apulcensis* LINDLEY (*Pinaceae*), a Misinterpreted Name for a Latin American Pine. — Novon 5: 252-256.
- FITZPATRICK H.M. (1929): Coniferae. Keys to the genera and species with economic notes. — Sci. Proc. Roy. Dublin Soc. n.s. 19: 189-260.
- FLETCHER H.R. & BROWN W.H. (1970): The Royal Botanic Garden, Edinburgh, 1670-1970. - Edinburgh.
- FORBES J. (1839): Pinetum Woburnense. - London.
- FRICS P.F. (1982): Eastnor Castle Estate. A List of Trees in the Castle Grounds. — Fothergill & Sherston, Land Agents and Forestry Consultants, Bath. pp. 17.
- FROST P. (1833): A notice of the species of pines added to the Pinetum at Dropmore. — Gard. Mag. 9: 559-561.
- GAUSSEN H. (1960): Les gymnospermes actuelles et fossiles. Le genre *Pinus*. — Trav. Lab. Forest. Toulouse, T. 2, Sect. 1, vol. 1, fasc. 6, ch. 11.
- GLOAG J. (1970): Mr Loudon's England. The life and work of John Claudius Loudon, and his influence on architecture and furniture design. - Newcastle upon Tyne, GB.
- GORDON G. (1849): Conifers collected in Upper California. — J. Hort. Soc. London 4: 211-220.
- GORDON G. (1872): *Pinus ponderosa* DOUGL. — Garden (London) 1: 10-11, 39.

- GORDON G. (1875): *The Pinetum*, 2nd. ed. - London: Henry G. Bohn.
- GORDON G. (1909): Gardens round Hertford. — *Gard. Mag.* 52: 949-974.
- GREUTER W., BARRIE F.R., BURDET H.M., CHALONER W.G., DEMOULIN V., HAWKSWORTH D.L., JORGENSEN P.M., NICHOLSON D.H., SILVA P.C., TREHANE P. & J. McNEILL (eds.) (1994): *International Code of Botanical Nomenclature*. — *Regnum Veg.* 131.
- HARTWEG C.T. (1847): *Journal of a mission to California in search of plants*, part 3. — *J. Hort. Soc. London* 2: 187-191.
- HARVEY A.G. (1947): *Douglas of the Fir. A biography of David Douglas*. - Cambridge, Mass.
- HEMSLEY W.B. (1909): *Pinus jeffreyi* GREV. & BALF. — *Curtis' Bot. Mag.* 135 (4th ser. 5): table 8257.
- HENRY A. (1914): A rare pamphlet on conifers. — *Gard. Chron.* (3rd ser.) 55: 12-13.
- HERRIN C. (1892): Conifers at Dropmore. — *J. Roy. Hort. Soc.* 14: 61-66.
- HOOKE W.J. (1829-40): *Flora Boreali-Americana*, 2 vols. - London.
- HOOKE W.J. (1836): A brief memoir of the life of Mr. David Douglas, with extracts from his letters. — *Companion Bot. Mag.* 2: 79-182.
- HOOKE W.J. (1853): (review of) *Botanical expedition to Oregon*. — *Hooker's (London) J. Bot. Kew Gard. Misc. n.s.* 5: 315-317, 395.
- JACKSON B.D. (1893 - ff): *Index Kewensis*. - Oxford.
- JAMES E. (1823): *Account of an expedition from Pittsburgh to the Rocky Mountains, performed in the years 1819, 1820, by order of the Hon. J.C. Calhoun, Secretary of War, under the command of Maj. S.H. Long, of the U.S. Top. Engineers; compiled from the notes of Major Long, Mr. T. Say, and other gentlemen of the party, by Edwin James, botanist and geologist to the expedition*. - Philadelphia.
- JAMES E. (1825): *Catalogue of Plants collected during a Journey to and from the Rocky Mountains, during the summer of 1820*. — *Trans. Amer. Philos. Soc. n.s.* 2: 172-190.
- JEPSON W.L. (1893): (review of) *On legitimate authorship of certain binomials, with other notes on nomenclature*. — *Erythea* 1: 123-124.
- JEPSON W.L. (1962): *California botanical explorers - XII: John Milton Bigelow*. — *Madrono* 16: 179-183.
- JOHNSTONE J.T. (1939): *John Jeffrey and the Oregon Expedition*. — *Notes Roy. Bot. Gard. Edinburgh* 20: 1-53.
- KARTESZ J.T. (1994): *A synonymized Checklist of the vascular flora of the United States, Canada, and Greenland*. - Portland, OR.
- KELLOGG A. (1882): *Forest trees of California*. — (*Bienn.*) *Rep. State Mineral. Calif.* 2: 1-116.

- KLAUS W. (1980): Neue Beobachtungen zur Morphologie des Zapfens von *Pinus* und ihre Bedeutung für die Systematik, Fossilbestimmung, Arealgestaltung und Evolution der Gattung. — Pl. Syst. Evol. **134**: 137-171.
- KOTOK E.S. (1973): Ponderosa pine. An American wood. — [Publ.] FS-254, USDA, Forest Service.
- KRAL R. (1993): *Pinus* LINNAEUS — In: FLORA OF NORTH AMERICA EDITORIAL COMMITTEE (ed.), Flora of North America North of Mexico, vol. 2: 373-398. - New York (N.Y.) and Oxford, GB.
- LAMBERT A.B. (1828, 1837): A description of the genus *Pinus*. 2nd ed. (folio), 3 vols (vols. 1 & 2, 1828, vol. 3, 1837). - London.
- LAMBERT A.B. (1832): A description of the genus *Pinus*, 3rd ed. (octavo), 2 vols. - London.
- LAURIA F. (1991): Taxonomy, Systematics, and Phylogeny of *Pinus*, Subsection *Ponderosae* LOUDON (*Pinaceae*). Alternative Concepts. — Linzer biol. Beitr. **23**: 129-202.
- LAURIA F. (1996): Typification of *Pinus benthamiana* HARTWEG (*Pinaceae*), a taxon deserving renewed botanical examination. — Ann. Naturhist. Mus. Wien **98B** (Suppl.). In press.
- LAWSON C. (1836): The Agriculturist's Manual. - Edinburgh.
- LEMMON J.G. (1889): Revision of broken-cone pines. — Calif. State Board Forest. Bull. **7**: 6-11.
- LEMMON J.G. (1895): Handbook of West-American cone-bearers, 3rd (pocket) ed. - Oakland, Calif.
- LEMMON J.G. (1897): Three Westamerican Conifers. — Gard. & Forest **10**: 183-184.
- LEMMON J.G. (1900): Handbook of West-American Cone-Bearers, 4th ed. - Oakland, Calif.
- LINK H.Fr. (1841): *Abietineae*. — Linnaea **15**: 506.
- LITTLE E.L. Jr. (1944): Notes on nomenclature in *Pinaceae*. Amer. — J. Bot. **31**: 587-596.
- LITTLE E.L. Jr. (1948): David Douglas' new species of conifers. — Phytologia **2**: 485-490.
- LITTLE E.L. Jr. (1953): Check list of native and naturalized trees of the United States (including Alaska). — Agric. Handb. **41**, USDA Forest Service.
- LITTLE E.L. Jr. (1979): Check list of United States trees (native and naturalized). — Agric. Handb. **541**, USDA Forest Service.
- LODDIGES C. (1830): Catalogue of plants in the collection of Conrad Loddiges & Sons, Nurserymen, 15th ed. - London.
- LODDIGES C. (1836): Op. cit., 16th ed. - London.
- LOOCK E.E.M. (1950): The pines of Mexico and British Honduras. — Bull. Forest. Union S. Africa **35**.
- LOUDON J.C. (1829): An encyclopaedia of plants. - London.
- LOUDON J.C. (ed.) (1830a): Horticultural Society and garden. — Gard. Mag. **6**: 504-507.

- LOUDON J.C. (1830b): Loudon's Hortus Britannicus. - London.
- LOUDON J.C. (1832): Loudon's Hortus Britannicus, 2nd. ed. - London.
- LOUDON J.C. (1834): Arboretum Britannicum; or, portraits from nature ... — Gard. Mag. 10: 558-564, 581-582.
- LOUDON J.C. (1836a): A list of places in Great Britain and Ireland from which return papers have been received for the Arboretum Britannicum. — Gard. Mag. 12 (n.s. 2): 28-34.
- LOUDON J.C. (1836b): (review of) 'Peter Lawson & Son, The Agriculturists Manual, Edinburgh, 1836'. — Gard. Mag. 12 (n.s. 2): 438-443.
- LOUDON J.C. (1836c): Dimensions of trees of the British Oaks (*Quercus Robur pedunculata* and *Q.R. sessiliflora*), and of the Cedar of Lebanon (*Cedrus Libani*), now growing in different parts of Britain and Ireland. — Gard. Mag. 12 (n.s. 2): 579-582.
- LOUDON J.C. (1836d): List of the most celebrated old oaks, cedars, larches, chestnuts, beeches, elms, ashes, sycamores, etc..., in Great Britain. — Gard. Mag. 12 (n.s. 2): 582-589.
- LOUDON J.C. (1836e): Biographical notice of the late Mr. David Douglas, F.L.S., the traveller and botanist; with a proposal to erect a monument to his memory; and a list of the plants which he introduced. — Gard. Mag. 12 (n.s. 2): 602-609.
- LOUDON J.C. (1838a): A tabular view of the species of *Abietinae* contained in the principal pinetums and collections of *Abietinae* in Great Britain and on the continent of Europe. — Gard. Mag. 14 (n.s. 4): 29-32.
- LOUDON J.C. (1838b): Arboretum et Fruticetum Britannicum, 8 vols. - London.
- LOUDON J.C. (1840): Notes on some country seats and gardens in Lincolnshire, Derbyshire, Staffordshire, Warwickshire, Middlesex, Surrey, Kent, and Hertfordshire, from May to October, 1840. — Gard. Mag. 16 (n.s. 6): 569-592.
- MACDOUGALL E.B. (1980): John Claudius Loudon and the early nineteenth century in Great Britain. — Dumbarton Oaks Colloquium on the History of Landscape Architecture 6, 1978. - Washington, D.C.
- MCKELVEY S.D. (1955): Botanical Exploration of the Trans-Mississippi West, 1790 - 1850. - Jamaica Plain, Mass.
- MASON H.L. & W.P. STOCKWELL (1945): A new pine from Mount Rose, Nevada. — Madrono 8: 61-63.
- MASTERS M.T. (1892): List of conifers and taxads in cultivation in the open air in Great Britain and Ireland. — J. Roy. Hort. Soc. 14: 178-243.
- MASTERS M.T. (1904): A general view of the genus *Pinus*. — J. Linn. Soc. 35: 560-659.
- MASTERS W. (1831): Hortus Duroverni, 3rd ed. - London.

- MAYR H. (1890): Die Waldungen von Nordamerika. - München: M. Rieger'sche Universitäts-Buchhandlung.
- MAYR H. (1906): Fremdländische Wald- und Parkbäume für Europa. - Berlin: P. Parey.
- MEISEL M. (1924-1929): A Bibliography of American Natural History. The Pioneer Century, 1769-1865, 3 vols. - New York, N.Y.: The Premier Publishing Co.
- MINAY P. (1991): Eighteenth and early nineteenth century Edinburgh seedsmen and nurserymen. — Book Old Edinburgh Club n.s. 1: 7- 27.
- MIROV N.T. (1967): The genus *Pinus*. — New York, NY.: Ronald Press.
- MITCHELL A.F. (1963): The Dropmore Pinetum. — Forest Record 48, Forestry Commission (GB).
- MITCHELL A.F. (1972a): Conifer Statistics; Noteworthy specimens of conifers in the British Isles. — In: ROYAL HORTICULTURAL SOCIETY (ed.), Conifers in the British Isles, Proc. 3rd Conifer Conference 1970, pp. 123-285; 286-293. - London.
- MITCHELL A.F. (1972b): Conifers in the British Isles. — Forest. Commiss. Booklet 33.
- MULLINS G. (1903): Eastnor Castle: Gardener and gardens. — Gard. Chron. 3rd. ser. 34: 155.
- MURRAY A. (1853): Botanical expedition to Oregon, — Reports 6 (16 April, 3 pp.), 7 (18 June, 2 pp.), and 8 (autumn, 3 pp. and 5 plates). - Edinburgh.
- MURRAY A. (1855): Description of new coniferous trees from California. — Edinburgh New Philos. J. n.s. 1: 284-295, pl. 6-11.
- MURRAY A. (1860): Notes on Californian trees. — Edinburgh New Philos. J. n.s. 11: 224-226.
- MURRAY E. (1982): Notae spermatophytae. — Kalmia 12: 18-28.
- NEWBERRY J.S. (1858): 'Botanical Report'. — In: Reports of explorations and surveys to ascertain the most practicable and economical route for a railroad from the Mississippi River to the Pacific Ocean, R.S. Williamson's and H.L. Abbott's report 6(III): 1-102. - Washington, D.C.
- NIEBLING C.R. & M.T. CONKLE (1990): Diversity of washoe pine and comparisons with allozymes of ponderosa pine races. — Canad. J. Forest Res. 20: 298-308.
- OUDEM P.DEN & B.K. BOOM (1965): Manual of cultivated Conifers hardy in the cold- and warm-temperate zone. - The Hague: M. Nijhoff.
- PARLATORE F. (1868): 'Coniferae'. — In: DE CANDOLLE A., Prodrômus Systematis Naturalis Regni Vegetabilis 16, part 2. - Paris: Victor Masson et Fils.
- PARRY C.C. & G. ENGELMANN (1962): 'Coniferae', Supplement to the enumeration of plants of Dr. Parry's collection in the Rocky Mountains. — Amer. J. Sci. 2nd ser. 34: 330-332.
- PETRAK F. (1948): Das Naturhistorische Museum im Kriege. Botanische Abteilung. — Ann. Naturhist. Mus. Wien 56: 10-13.

- RAVENSCROFT E.J. ([1863-]1884): The *Pinetum Britannicum*. A descriptive account of hardy coniferous trees cultivated in Great Britain, 3 vols. — Edinburgh and London: W. Blackwood & Sons (issued in 52 parts written by J. LINDLEY, A. MURRAY and M.T. MASTERS, see B.B. WOODWARD, *Gard. Chron.* 3rd ser. 36: 36-37 [1904]).
- REHDER A. (1949): Bibliography of cultivated trees and shrubs hardy in the cooler temperate regions of the northern hemisphere. - Jamaica Plain, Mass.: Arnold Arboretum of Harvard University.
- ROBERTS W. (1936): The centenary of Loudon's 'Arboretum'. — *J. Roy. Hort. Soc.* 61: 277-284.
- ROBSON J. (1865): Bury Hill. The seat of A.K. Barclay, Esq. — *J. Hort. Cottage Gard.* 33: 7-9.
- SARGENT C.S. (1884): Report on the Forests of North America (North of Mexico), Tenth Census of the United States, volume IX. Department of the Interior, Census Office. - Washington, D.C.
- SARGENT C.S. (1888): The weeping *Pinus ponderosa*. — *Gard. & Forest* 1: 391-392.
- SARGENT C.S. (1891-1902): The silva of North America, 14 vols. - Boston and New York.
- SÉNÉCLAUZE A. '1868' (1867): Les Conifères. - Paris: Ch. Lahure.
- SHAW G.R. (1914): The Genus *Pinus*. — *Publ. Arnold Arbor.* 5.
- SIDWELL R. (1981): West Midland Gardens. - Alan Sutton.
- SIMO M.L. (1988): Loudon and the Landscape. From Country Seat to Metropolis 1783-1843. - New Haven.
- SMITH G.L. & C.R. WHEELER (1992): A Flora of the Vascular Plants of Mendocino County, California. — *Wasmann J. Biol.* 48-49.
- STAFLEU F.A. & COWAN R.S. (1981): Taxonomic Literature, 2nd. ed., vol. 3. - Utrecht.
- SUDWORTH G.B. (1893): On legitimate authorship of certain binomials with other notes on nomenclature. — *Bull. Torrey Bot. Club.* 20: 40-46.
- SUDWORTH G.B. (1895): '*Coniferae*'. In: HOLZINGER J.M., Report on a collection of plants made by J.H. Sandberg and assistants in northern Idaho, in the year 1892. — *Contr. U.S. Natl. Herb.* 3, No 4: (205-) 266-267 (-287).
- SUDWORTH G.B. (1897): Nomenclature of the arborescent flora of the United States. — *USDA Div. Forest. Bull.* 14.
- SUDWORTH G.B. (1898): Check list of the forest trees of the United States, their names and ranges. — *USDA Div. Forest. Bull.* 17.
- SUDWORTH G.B. (1917): The pine trees of the Rocky Mountain region. — *Bull. USDA* 460.
- SWEET R. (1830): Sweet's *Hortus Britannicus*, 2nd ed. - London.
- UNITED STATES FOREST PRODUCTS LABORATORY (1974): Wood Handbook. Wood as an engineering material. — *USDA, Agric. Handb.* 72 (revised).

- WEBER W.A. (1982): New names and combinations, principally in the Rocky Mountain flora, 2. — *Phytologia* **51**: 369-376.
- WEIDMAN R.H. (1939): Evidences of racial influence in a 25-year test of ponderosa pine. — *J. Agric. Res.* **59**: 855-887.
- WELLS O.O. (1964): Geographic variation in ponderosa pine, I. The ecotypes and their distribution. — *Silvae Genet.* **13**: 89-103.
- WHITE C.A. (1902): Memoir of George Engelmann (1809-1884). — *Biogr. Mem. Natl. Acad. Sci. U.S.A.* **4**.
- WOODWARD R. (1907): Catalogue of hardy trees and shrubs, including coniferae, growing in the grounds of Arley Castle. — Published by the author.

Address of the author: Friedrich LAURIA,
Botanische Abteilung, Naturhistorisches Museum,
Burgring 7, P.O.Box 417, 1014 Vienna, Austria.